

William Robinson
GEODÆSIA HIBERNICA: 1839

OR AN

E S S A Y

ON

PRACTICAL SURVEYING.

Which contains the following

USEFUL IMPROVEMENTS.

- | | |
|---|--|
| I. PROTRACTION without
Parallels, &c. | IV. A New Method and Plan
of Calculation, proposed to
Practitioners, to give in re-
turn with their Surveys. |
| II. A Description of a new IN-
STRUMENT, by which any
Gentleman, tho' unskill'd
in Surveying, may measure
a Map, or Part of a Map,
almost in one View. | V. A new Set of TABLES, in
which may be found, by
<i>Inspection only</i> , the DIFFER-
ENCE of LATITUDE, and
DEPARTURE, for a Station
of any Length and Bearing
that may happen in Practice. |
| III. Different METHODS for
correcting Surveys, and fit-
ting them for Calculation. | |

Ye shall do no Unrighteousness in Judgment, in Mete-yard, in Weight, or in
Measure. *Levit. chap. xix. ver. 35.*

Curfed be *he* that removeth his Neighbour's Land-Mark: And all the
People shall say Amen. *Deut. chap. xxvii. ver. 17.*

By BENJAMIN NOBLE.

D U B L I N:

Printed for the AUTHOR, by ALEX. M'CULLOH, in
Henry-street, 1768. And sold by E. SPICER, Mathematical
Instrument-Maker, ISAAC JACKSON, in *Meath-street*,
and the AUTHOR, in BALLINAKIL.

GEODÆSIA HITTITICA:

OR AN

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ON

PRACTICAL SURVEYING

Which contains the History

USEFUL IMPROVEMENTS

1. A new Method and Plan
of Calculating, proposed to
Engineers, to give in re-
sult with their Survey.
2. A new Set of Tables, in
which may be found, by
the use of the Gunter-
line, or Table, and
used of Latitude, and
Departures, for a Station
of any Length and Bearing,
that may happen in Practice.

48.

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1. A Description of a new In-
strument, by which may
be obtained, the Position
of a Point, with respect
to a Line, or Part of a Map.
2. A new Method for
correcting Surveys, and for
finding them for Change.

40.

To find the true Length, bearing, and Position, in a Survey, or in

any other Case, by the use of the Gunter's Line, and the



By JOHN WILKINSON

THE UELIN:

Printed for the Author, by J. G. & Co. in
St. Paul's Church-yard, London.
And the Author, in BATH.

TO
JOSEPH HENRY, Esq;
THIS
TREATISE
ON
LAND-SURVEYING

IS
DEDICATED

BY

His very humble Servant,

BENJ. NOBLE.

TO THE NEW YORK

THIS

TREASURY

ON

LAND SURVEYING

IN

DECEMBER

BY

THE NEW YORK

LAND SURVEYING

T H E
P R E F A C E.

L A N D is now become of so high a price in this kingdom, that the Art of Surveying ought to be performed with greater accuracy than perhaps is commonly the case. For want of proper *Tables* of difference of *Latitude* and *Departure*, the more correct methods hath been in a great measure too much neglected.

It is now above forty years since Mr. BURGH, Surveyor-General of *Ireland*, first published the method of calculation. And I believe I may venture to say, that the art has remained in a state of non-improvement, in respect either of accuracy or expedition since his time. How far I have succeeded in supplying the wants in these points, I leave to the candid reader to judge.

In the following work I have laid down a plan of calculation, to be given in return with surveys, which I have practised myself for some time past. And I hope
the

the votaries of *Correctness*, both Gentlemen and Surveyors, will use their endeavours to make it become a general custom. This would make calculation be more inspected into, better understood, and perhaps thereby receive further improvements. Nothing could be thought of to make the tracing of old mearings or furveys, to become so easy as the registering of field-notes after this manner: For it may be said that this is a map laid down by a scale as large as the land itself; and by only allowing for the change in the variation of the needle, when such is used, every single station, and even off-sets, &c. may be laid out on the ground, at any distance of time after the survey was made, if only the place of some remarkable and immovable object be inserted in the survey; even supposing the mearings to be intirely defaced and lost.

I shall here add an extract from some observations on the variation of the needle, by our ingenious countryman, Mr. WILL. MOLYNEAUX, (Philoso. Transf. No. 230.)

“ The variation of the magnetick needle is so commonly known, that I need not insist much on the explication thereof;
“ of;

“ of; ’tis certain that the true solar meri-
“ dian, and the meridian shewn by the
“ needle, agree but in very few places of
“ the world; and this too but a little time
“ (if a moment) together; the difference
“ between the true meridian and magne-
“ tick meridian, perpetually varying and
“ changing in all places, and at all times;
“ sometimes to the eastward, and some-
“ times to the westward.

“ On which account, ’tis impossible to
“ compare two surveys of the same place,
“ taken at distant times by magnetic instru-
“ ments, (such as the *Circumferentor*, by
“ which the *Down Survey*, or Sir WILLIAM
“ PETTY’S *Survey of Ireland* was taken)
“ without due allowance be made for this
“ variation. But then I would not be un-
“ derstood that it affects any thing but the
“ situation of the ground, or the bounds
“ between the proprietors of different estates.
And then tells us, “ That about the year
“ 1657 (at which time the *Down Survey*
“ was taken) the magnetic meridian, and
“ true meridian did agree at *Dublin*, or
“ pretty nigh all over *Ireland*; that is to
“ say, that there was no variation: And
“ indeed by experiment it was at that time
“ found, as I am well assured, that at *Dub-*
“ *lin*

“ *lin* it was hardly half a degree:” and by an observation which he made himself, he tells us “ That in the year 1695, the variation was 7 degrees from the north to the westward.” Mr. MOLYNEAUX then concludes his observations in these words, “ From what has been already laid down, we may see the absolute necessity of allowing for the variation of the magnet, in comparing old surveys with new ones; for want of which, great disputes may arise between neighbouring proprietors of land: and it were to be wished that our honourable and learned Judges would take this matter into consideration, whenever any business of this kind comes before them.”

The following TABLE shews the Variation of the magnetick Needle at *London* and *Dublin* in the Years annexed.

At London in the Year	At Dublin in the Year	Variation.
		0 /
1580	- - -	11 15 E.
1622	- - -	6 00 E.
1634	- - -	4 05 E.
- - -	1657	0 30 W.
1672	- - -	2 30 W.
1683	- - -	4 30 W.
- - -	1695	7 00 W.
1700	- - -	7 30 W.
- - -	1722	11 15 W.
- - -	1751	19 00 W.
- - -	1768	22 45 W.

GEODÆSIA HIBERNICA, &c.

DEFINITIONS.

DEFINITION I.

LAND Surveying, is an Art that teacheth how to find how many Times any customary Measure is contained in any given Piece of Ground, and to exhibit the true Bounds of the same by a Map.

The common Standard Measure mostly used in *Ireland*, by which we express the Contents or Quantity of any Piece of Ground, is the Acre, containing four Roods, each Rood forty square Perches, the Perch consisting of seven Yards in Length, the square Perch 49 square Yards; therefore the Acre contains $78\frac{40}{50}$ square Yards, or 160 square Perches. In *England*,
B their

their Acre contains as many square Perches as ours, but their Perch is only $5\frac{1}{2}$ Yards in Length, so that their Acre contains only 4840 square Yards. Hence an *Irish* Acre is to an *English* Acre in the Proportion of 7850 to 4840, or as 49 to $30\frac{1}{4}$, which last are the Squares of the *Irish* and *English* Perches.

DEFIN. II.

A Station, is a straight Line, whose Length is measured, mostly with a Chain, and Bearing taken with an Instrument, and may be on the Land to be surveyed, or on that measuring it, but is generally near the Bounds.

DEFIN. III.

The Bearing of a Station, is the Inclination or Angle that it makes with a North and South Line or Meridian passing over it.

For all Meridians passing over any Station or Survey, are supposed to be parallel. It matters nothing to a Surveyor whether the Needle of his Instrument varies from the North or no; all that is requisite in this Point is, that the Needle may keep its parallel Position throughout the whole Survey, though it is sometimes drawn from its Parallelism by the Attraction of Iron Mines

Mines concealed in the Bowels of the Earth; but the Surveyor must have a watchful Eye when there is any Reason to mistrust the like Effects.

DEFIN. IV.

Direct Stations, are those Stations which follow each other in a natural direct Order, according to the Succession of the four Quarters of the Compass.

In taking a Survey, the Land is always surrounded with Stations, the following still beginning where the foregoing ended, and the End of the last Station falls exactly into the Beginning of the first, which closes the Work; so that a Survey hath generally Stations whose Bearings are in the NW. SW. SE. and NE. Quarters of the Compass; and all Stations following one another in the same Succession of these four Quarters, are called direct Stations. Though there may be a Survey without Stations in one of these Quarters, or even in two: As for Example, a Survey may have all the Stations in the NW. and SE. Quarters, wanting the SW. and NE. Quarters; but when a Survey hath all its Stations in two Quarters of the Compass, they are always opposite Quarters.

DE-

DEFIN. V.

Indirect or Retrograde Stations, are those Stations in respect of the rest, which bear backward or contrary to the natural Succession of the four Quarters of the Compass.

If in proceeding southerly from the extreme Point North, there happen a Station to turn northerly, or in proceeding northerly from the extreme Point South, there happen a Station to turn southerly, such Stations are Indirect or Retrograde Stations: The same may be said of Stations that turn after the like Manner in proceeding from the extreme Points east and west of the Survey.

DEFIN. VI.

The Difference of Latitude of a Station, is the Distance North or South that a Surveyor advances in measuring the Length of that Station, and is measured on a Meridian, or North and South Line.

As the Station bears to the North, or to the South, the Difference of Latitude is called the northing or southing of that Station.

DEFIN. VII.

The Departure of a Station, is the Distance

stance that a Surveyor advances to the East or to the West in measuring the Length of that Station, taken on a Parallel of Latitude, or East and West Line.

If the Station bears towards the East, the Departure then is called the Easting of that Station; if it bears towards the West, then the Departure is called the Westing of that Station. Every Station, with its Difference of Latitude and Departure, form a right angled Triangle, the Hypothenuse of which is the Station itself, and the Latitude and Departure are the two Legs about the right Angle, the Bearing of the Station is one of the oblique Angles, and the Complement of the Bearing is the other.

DEFIN. VIII.

The Extreme Points, North, South, East or West of a Survey are, the Ends of those Stations which run more to the North, South, East or West than any other Station in the Survey.

Though most Surveys have these four extreme Points, yet there are some Surveys where one and the same Station may be the greatest extreme North, and at the same Time the greatest extreme East or West; or one and the same Station may be

be the exrteme South, and likewise the extreme East or West.

DEFIN. IX.

The Latitude of a Station, is the meridional Distance of the End of a Station to the North or to the South, from a given east and west Line, or parallel of Latitude.

The Parallels mostly made use of in this Case, are those east and west Lines passing through the Extremes north and south of the Survey. Now if the Latitudes of each Station be found from the extreme North, then it is the Distance that the End of each Station is to the South of that Point, and the Station that is the greatest extreme South will have the greatest Latitude: But if the Latitudes be found from the extreme Point South, then the Latitude of each Station will be the Distance that the End of each Station is to the North of that said extreme Point South, and the Station that is the greatest extreme North will have the greatest Latitude, and the Latitude of the extreme North from the South, or the Latitude of the extreme South from the North, which are the same, will be the greatest meridional Breadth of the Ground: The same may be said of the whole

whole or absolute Departure of each Station from the extreme east or west Points of the Survey. And the whole or absolute Departure of the greatest extreme East from the extreme Point West, or the whole Departure of the extreme West from the extreme Point East, which is the same, will be the greatest parallel Breadth of the Ground.

DEFIN. X.

The Semi-rectangle of a Station, is a Figure limited by the Latitudes of both Ends of the Station; the Station itself; and a Section of the Parallel from which the Latitudes are measured, equal to the Departure: and when the last mentioned is indirect, the Semi-rectangle is indirect also.

What is here said of the Latitudes, may be also said of the whole or absolute Departures.

DEFIN. XI.

The Circumscribing Parallelogram of a Survey, is a Rectangle or Parallelogram circumscribing the Body-of-the-Land, whose four Sides passing through the four Extremes N. S. E. and W. of the Survey, are two Meridians, and two Parallels of Latitude.

The two Sides of this Parallelogram which are Meridians, are equal, or the same

same with the Latitude of the extreme North from the extreme South, or the extreme South from the extreme North; or the greatest meridional Breadth of the Survey. The other two Sides are equal to the greatest parallel Breadth of the Ground, or the Distance of the extreme Points East and West, measured on an east and west Line, which is also the greatest Departure.

DEFIN. XII.

The Body-of-the-Land is the Area of a Map or Survey, included between all the Stations, without taking Notice of the Offsets or Insets.

DEFIN. XIII.

An Off-set or Inset, is the Distance of any angular Point in the Bounds from the Station Line, measured perpendicularly, or at right Angles thereto.

An Off-set differs from an Inset thus: An Off-set is always taken on the Land to be surveyed, but an Inset on that measuring it. And as the Content arising from all the Off-sets are to be added to the Body-of-the-Land, so the Content of the Insets are to be taken therefrom to come at the true Content of the Ground.

For

For Further Explanation, see Fig. 6.

In which the Lines 1, 2—2, 3—3, 4— &c. are Stations surrounding the Body-of-the-Land.

The four Points N. S. E. W. the four Extremes, North, South, East and West.

The Angle 1, 2 T is the Bearing of the first Station 1, 2.

And 2 T its Difference of Latitude.

1 T its Departure.

2 L its Latitude	— — —	} from the {	North. South. East. West.	^Cl ^Dl
2 l its Latitude	— — —			
BL, or BL its whole Departure				
AL or BL its whole Departure				

1 R the Latitude of the last Station, or Beginning of the first.

1 R L 2 } is a Semi-rectangle to Station 1 from { North.
1 M l 2 } Extreme { South.

And A B C D is the Circumscribing Parallelogram.

The Stations 1 and 4, are indirect Stations, and the Semi-rectangle to Station 4, viz. 5gO4 is an indirect Semi-rectangle.

The small Lines a b &c. are Off-sets on Station 3, and the Lines d e &c. are Insets to Station 6, &c. See Figure 5.

POSTULATE I.

Grant that the Distance of two Objects, or the Length of a given accessible Line, may be found in some known or customary Measure, by the Application of some given Line of known Measure.

POSTULATE II.

Grant that an Angle, or the Inclination of one Line to another, may be found or measured by the Application of a Circle, divided into a given Number of equal Parts.

The field-work of Surveying is made up of, and I may say, the accuracy of the whole process entirely depends on the mechanical measurement of a Line and an Angle. And tho' it cannot be expected that whatever is done by the hands of man, will ever arrive to mathematical certainty, yet a Surveyor, by proper care, may discover the lengths of his lines, and the quantity of his angles so near the truth, that the errors arising from the inaccuracy of practice, may be easily corrected and amended, when the work comes to be calculated.

AXIOM

AXIOM I.

All Right-Lines whose Lengths are to be multiplied together in finding the Content of any Figure, must be taken at Right-Angles to each other, or as near as possibly they can.

AXIOM. II.

The Content of every four sided Figure that hath two of its Sides parallel, is equal to half the Product arising from the Sum of the parallel Sides, multiplied into their perpendicular Distance.

This is true in respect to the square, and rectangle, or right-angled Parallelogram; for (by 34 *Eucl. I.*) the rule is, to multiply one side into the other for the content. It's true likewise in respect of the Rhombus and Rhomboides, for (by ³⁵*Eucl. I.*) the rule is to multiply one side, or the base, into the perpendicular altitude; these figures have their two opposite sides parallel. But in respect of the Trapezium that hath only two of its sides parallel, as the figure ABDE, or ARPE having EPD, and AR ~~DB~~ parallel; the truth of it may be proved thus: any where in the figure, let the perpendicular distance be drawn, suppose
in

in PR this cuts the figure into two parallel rectangular Trapeziums viz. $ARPE$ and $BRPD$; let the line RA be continued out, and make AL equal to EP , likewise continue the line PE , and make EN equal to RA , draw the line NL which (by 33 *Eucl.* I.) is equal to PR . Now by the construction the figure $LNPR$ is a rectangle under the sum of the parallel sides AR , PE , and their perpendicular distance PR , or LN , and is double the Trapezium $ARPE$; for if the figure $ARPE$ was laid on the figure $ALNE$ they would agree in all their parts, PR to LN , PE to LA , and RA to NE , and the point A in one would be on the point E in the other, therefore the figures $ARPE$ and $ELNA$ are equal, and consequently the rectangle $LNPR$ is double the Trapezium $ARPE$. The same may be said of the parallel-rectangular Trapezium $BRPD$, for it is equal to half the rectangle $RPGF$, under the sum of the two parallel sides PD , RB and their perpendicular distance PR , and of consequence the whole Trapezium $ABDE$ is equal to half of the rectangle $LNPF$ arising from the sum of the parallel sides ~~RB~~ and

and DE multiplied into their perpendicular distance PR.

If the shortest sides of the parallels DE was supposed to move in its parallel situation until it became equal to nothing in the point C, the Trapezium ABDE would then be changed into the Triangle ACB, or have its side DE equal to (0); now if (0) be added to the side AB and multiplied by the perpendicular CR, the product will be double the Triangle ACB, agreeable to the rules already laid down, which is (41 *Eul. I.*) to multiply half the base by the altitude, or half the altitude by the base, for the content of the Triangle. The same may be said of the parallel-rectangular Trapezium, or Semi-rectangle, ARPE changing into the right-angled Triangle ARC by the motion of the line PE, and becoming equal to (0) in the point C, or PE may become equal to (0) in the point E by the motion of PR into ES, and then the Semi-rectangle ARPE will be changed into the right-angled Triangle ASE. See Fig. * 3.-

SCHOLIUM.

Upon a thorough knowledge of this figure ARPE, which I call a Semi-rectangle,

rectangle, (and I think it is a very proper name both for it and for the right-angled Triangle into which it changes, by having the shortest parallel side becoming equal to (o).) I say upon a thorough knowledge of this figure, and its application, depends the whole calculation of a Survey: Both the calculation of the Body-of-the-Land, and the calculation of the Off-sets and Insets: For suppose A E to be a Station, and P R the section of a parallel of latitude, or east and west line from which the latitude of each station is reckoned; then will A R be the latitude of the end of the station, and P E the latitude of the beginning, or which is the same thing, the latitude of the end of the foregoing station; P R will be its departure, and S A its difference of latitude, and this must be considered of every station thro'out the whole Survey. In respect of the Off-sets and In-sets, if A E represent the distance of two angular points in the bounds, and R P a section of the station passing by these points, then will A R and E P be Off-sets or In-sets, according as they are on or off the land to be surveyed; and P R will be their intermediate distance on the station line. The line
P E

PE in either of these cases, may be supposed equal to (o), and then the Semi-rectangle will be a right-angled Triangle, as the Triangle ACR; but the point C will be one of the extreme points of the Survey, supposing CA a station, it having no latitude from the parallel CR: But if the line be considered as part of the bounds, then the station line CR, or chaining, crosses or touches the bounds in the point C: But more of this when we come to a more proper place.

PROPOSITION. I.

PROBLEM.

To measure the Length of a Line, or Station, or to find the Distance of any two Objects in the Fields, which are accessible to each other.

The instrument amongst Surveyors, for expressing the lengths of lines, is the chain of four perches, divided into 100 links, each link (10.08) ten inches, and eight ^{hundredths} ~~perches~~ of an inch in length. But in *England*, though their four-pole chain contains 100 links as well as ours, yet their perch being only $5\frac{1}{2}$ yards, the length of each link in their chain is only

only 7.92 inches. If the length of a line containing 29 perches was measured with this chain, it will be found to contain (7.25) seven chains twenty-five links, or which is the same, seven hundred and twenty-five links. If the length was 47.6 perches, then the length in chains will be found to be 11.90 Ch. or eleven hundred and ninety links; it may be read either ways. The tenth of a perch is equal to 2.5 links, a whole perch is 25 links, and a square perch contains 625 square links, a rood or 40 square perches 25000 square links, and a whole acre being four roods, contains 10.0000 square links, or ten square chains. A chain being 4 perches in length, one square chain will contain 16 square perches, which is the tenth of 160, the perches in an acre: Therefore ten square chains, or one hundred thousand square links make an acre, and this in *England* as well as in *Ireland*.

Tho' the lengths of lines are mostly expressed by Surveyors in four-pole chains or links, especially through the course of calculation, yet the mechanical measurement of lines or stations are mostly performed here in this kingdom, with the
half-

half-chain of two perches or fifty links. Our four-pole chain is rather too long and unhandy for common practice; but indeed the four-pole *English* statute chain, is of a very convenient length for practising with; and some Surveyors do take their field-notes with this chain, and when they have cast up the work, reduces it from statute to plantation measure. Every chain is commonly divided into ten equal parts, by marks at every ten links, so that one link is the decimal of one of those parts, and one of those parts the decimal of the whole chain, when set down in figures: and nothing could be more convenient than this decimal division of the chain, first contrived by one Mr. *Gunter*. Besides these marks at every ten links, the half-chain hath a mark at twenty-five links, or the middle, all which is for the more readily counting any number of links on the chain at any time.

Let us now come to the use of it in measuring the length of a line: you must first provide yourself with nine iron pegs, of about eight or ten inches in length, made somewhat weighty at the lower end, but thin and slight upwards, that they may the better drop perpendicular when requisite;

site; then with a man to hold your chain, go out to some open plane, and take any two marks at a convenient distance from each other; set off from one of them, holding one of the rings of the chain thereto, directing the man who holds the other end, to come in a line with the other mark, and then to stick down a peg: if he holds the ring of the chain to the middle of the peg between his fingers and thumb, he can by doing so, stick down the peg straight, and also keep the chain from having a deep swag; then do you come up to the peg that he stuck down, and holding the ring of the chain nicely to it, direct the man to stick down another peg in a line with the mark, so repeating this till you have gotten all the pegs; if the distance be longer, let the chain-man lay down a chain without a peg, whilst you come up to him and give him the pegs, and so proceed as before, till all the pegs are out again. Every time you return the pegs, which is at the end of every ten chains, is called a Change. When you come up to the mark, there are three things you must very well mind, which is the number of changes you have had, the number of pegs you have yourself, and the number of links which reaches

reaches from the last peg to the mark. Suppose you have had three changes, and you have four pegs in your hand, and the mark to be at 20 links on the last chain, then it is evident that the length of the line was 34 chains, 20 links, which is what you must set down. I would advise Beginners to practise thus, before they would venture on a Survey, and even to measure the lines over and over, to see how accurately they can chain.

PROPOSITION II.

PROB.

To lay down or measure the Length of any given Line or Station, by a Scale of equal Parts.

If a right line be divided on brass, wood, paper, &c. into any number of equal parts, it is called a *Scale of equal parts*: and if there be twenty divisions in each inch of the line, it is then called a scale of 20; if forty divisions, then a scale of 40, and so on. Each of these small divisions may represent a mile, chain, perch, yard, foot, or any other measure.

The scale of equal parts is of the same use to the map, as the chain is to the land,

land, viz. for laying down and measuring of lines; and since (by 20 *Eucl.* VI.) all like poligons are in a duplicate proportion to their like sides, and the like sides, as is their like, or similar parts, it follows, that the area of any piece or parcel of ground is in proportion to that of its map, as a square perch is to a square whose side is equal to the small division on the scale, representing a perch: that is, the *Area* of any piece or parcel of ground, is in proportion to that of its map, laid down by a scale of twenty perches in an inch, as 25401600 is to unity: so that the land is above twenty-five million of times greater in area than its map, at twenty perches to the inch; and when the map is laid down by a scale of forty perches in an inch, the land will be then above one hundred million of times greater than that of its map; so that its hard to think that any man can to any great degree of nicety, come at the content of the former, by a measurement of that of the latter, let the operation be done with ever so much accuracy and exactness. The scale is usually numbered with 10, 20, 30, &c. as far as is convenient thereon. (See fig. 1.)

Now,

Now, to take any number of miles, perches, &c. from the scale, as suppose 67, you must put one point of your compasses on 60, and open it so as the other point may fall on 7 of the small divisions before (o) which extent of the compasses being laid on paper, as A B will be the length, or number required. After the same manner may be taken from the scale any other number whatsoever. If there be a line, or the distance of any two points, given to be measured on the scale, it is only to take the length of the line, or distance in the compasses, and apply it to the scale. Suppose the part A D of the line A B was to be measured on the scale, you will find it to reach from 40 to 4 on the small divisions before (o), which shews it to be 44, and the part B D if measured on the scale, will be found to be 23. Thus you may measure the distance of any two places, &c. in a map, or plan of a Farm, Town, County, or Kingdom, by taking their distance asunder with your compasses, and applying it to the scale by which the map was laid down.

Geographical maps, or maps of kingdoms, or plans of cities, &c. which are laid down mostly by uncommon scales,
hath

hath generally a scale in some part thereof, or on the margin, by which the distance of any two places therein may be found: but in maps of small farms, it is sufficient, (except for ornament) to mention the scale by which it was laid down.

PROPOSITION III.

P R O B.

To take the Quantity of an Angle in the Field, or to find the Bearing of any Line, Station, or distant Object.

All the various instruments that are used for taking the quantity of an angle, or to measure the inclination of one right line to another, depend on the antient division of a circle into 360 equal parts, called degrees. Among Surveyors, for answering this problem, there is the *Theodolite*, *Semicircle*, *Circumferentor*, *Plain-Table*, &c. But the *Theodolite* containing, as it were, all the rest, and being held in most esteem by the best artists, I shall confine myself to the description of it only; for he that knows how to use the *Theodolite*, cannot fail to know how to use any instrument of the like nature. Figure 4 represents a *Theodolite* as it is now made, where
the

the brass circle N. W. S. E. about ten inches diameter, is divided into 360 equal parts, beginning at N. the north, and numbered 10, 20, 30, 40, &c. to W. the west, at 90 degrees, and so on to S. the south, at 180, from thence to E. the east, at 270, and so to N. again at 360, where the numbering begins and ends. Besides this numeration of the whole circle into 360 degrees quite round, it is likewise numbered into four nineties, or quadrants, by reckoning from N. and S. both ways. to E. and W. as may be seen by the figure, and these four 90's, called the *four quarters of the compass*, are used in finding the bearing of any line or station, to the east, or to the west, from a meridian, or north and south line. To the center of the circle is fixed an index, as IX which turns quite round, to the ends of this is fixed a pair of sights TX and SI, at right angles to the plane of the whole instrument. On this index, and concentric with the larger circle, is fixed a box *esw* about four or five inches diameter, and covered with glass, in which plays a needle, that sets to the north and south points of the world, by being properly touched with a load-stone or magnet for that purpose. The ring of this box

box is divided and numbered exactly as the former, only that the east and west points are marked contrary, it being customary to take the bearings of stations with the box at the south end of the needle.

When this instrument is to be used, the whole is set upon a three-leg-staff, but the box and needle with the index, may be unscrewed from the rest, and fixed on the staff by itself, and then the instrument is called a *Circumferentor*. *Fig. 7.*

Suppose the angle ABC , to be the corner in a field, formed by the two hedges or walls, AB and BC , and suppose the number of degrees in this angle was required: Set up the instrument at the point B , as nearly level as possible; then set the center line of the index over the points N . and S . the lower eye-slit at X , over 180 , and the teller end of the index at 360 ; turn the whole circle until you can see through the eye-slit over 180 , the hair in the opposite sight IS to cut an object at A , then screw the instrument fast, and turn the index by itself until you can likewise see through the same slits an object at C , and then you will have (68) the number of degrees contained in the angle, cut by the center line of the index

at

at (n) on the large circle. The bearings of the lines AB and BC, or the angles which they make with the meridian N. S. may be found by the box and needle only; thus, through the lower eye-slit, next the flower-de-luce; see that the hair in the other sight cuts the object at A, and when the needle settles, the south end thereof will cut the bearing of the line AB, which is S W. 27 degrees in the quarter-compass, or 153 in the degrees of the whole circle. The bearing of the line BC, from the point B, may be found after the same manner to be S E. 41, or in the whole circle 221 degrees. If at first, by the assistance of the needle, the points N. and S. on the large circle be fixed north and south, which is the same, as to make the diameter N. S. coincide with the needle or meridian line, you then may see that whatever degree or bearing the needle settles to, the teller-end of the index will always cut exactly the same on the limb of the *Theodolite*, if the needle be not newly affected by its approach to iron, or iron mines.

The circles of old *Theodolites* have generally the degrees divided into quarters, or diagonal lines thereon, by which we

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may

may discover the quantity of angles to quarters of degrees, or more nice if required. But our modern *Instrument-makers*, do divide the circle into degrees only, and instead of the forementioned divisions, they have introduced a division called a *Nonius*, from the contriver thereof; the nature of which is this: Suppose a line or ruler (Bb) to be divided into 11 equal parts as inches; suppose another ruler (Aa) exactly of the same length, to be divided into 10 equal parts; now it is evident that each of the divisions on the line Aa will be one tenth of a division greater than those on Bb: if these two rulers or lines be laid together so that their ends may exactly join A to B, and a to b, and then if the ruler Aa be moved 'till the line 1 and 1 on each ruler shall coincide, it is plain that the point A is advanced from the point B, $\frac{1}{10}$ of a division or inch, when the lines 2 and 2 coincide, then is A past B $\frac{2}{10}$, and so on until the lines 9 and 9 coincides, and then it is evident that A is past B $\frac{9}{10}$ of a division. A *Nonius* is thus fixed to a *Theodolite*, at or near each end of the index is an oblong aperture or opening that admits the degrees of the circle to be seen as the index slides over them; on the inside edge of

of these apertures as at (n) is cut a *Nonius* at each side of the center line of the index, which slides round exactly to the circle on which the degrees are cut. By this *Nonius*, we come to know how much of a broken degree is at any time cut by the center line of the index, and that to an exactness surpassing any thing that could be attempted by estimation.

PROPOSITION IV.

P R O B.

To lay down, or measure on Paper, the Quantity of any given Angle.

The different instruments we have for answering this problem, like the foregoing, is either a whole circle divided into 360 degrees, or part thereof, or some other instrument dependent thereon, as the *scale of chords*, which is only the breadths of the angles in a quadrant, or 90 degrees, laid on a straight line, to be used with a pair of compasses. But the chief instrument among Surveyors for this purpose, is a semi-circle containing 180 degrees, made of brass, ivory or horn, about four or five inches diameter, and is called a *Protractor*, (see fig. 2.)

Now,

Now, suppose you were to draw a line from the point B, or end of the line BA, that shall make an angle of 68 degrees with the said line ~~AB~~. ^{Fig. 7.} Lay the center of the *Protractor* on the point B, and let the line ~~AB~~ cut the beginning of the degrees, or be in a line with the diameter of the *Protractor*; then at 68 on the arch of the *Protractor* make a point, or mark with the protracting-pin; from this mark, draw a line to the point B, and the thing is done. To find the quantity of an angle given, as the angle ABS or CBS, lay the center of the *Protractor* on the vertex of the given angle, as at B, and let one of the legs cut the beginning of the degrees, and the other leg, at the same time, will cut the number of degrees contained in the angle. Thus you may find the angle ABS to be 27 degrees, and CBS 41. When the legs are shorter than the radius of the *Protractor*, they must be lengthened out. *Protractors* have generally scales of 20 in an inch, cut on their straight edge, which are used in making and measuring of maps.

PROPOSITION V.

P R O B.

To prove an Instrument.

A *Theodolite* or *Circumferenter* &c. may have various faults, even from the hands of the maker, the principal of which are, the degrees may be unequal and badly divided; the center may be faulty and wrong placed; or the brass of the instrument may be impregnated with iron particles, and affect the needle differently in different positions. When an instrument has any of those faults, the work done thereby, must undoubtedly be faulty too, though at the same time it may appear to be good work from the balancing of errors. Therefore a Surveyor cannot be too careful in getting a good instrument, and keeping it in good order, since so much depends thereon. The best method of trying an instrument, in my opinion, is this: Go into an open field, and at convenient distances from each other, set up three marks forming a triangle; with the instrument take the three angles of this triangle, very nicely, which note down on paper, (the observation being repeated in different triangles)

angles) and still if these three angles added together, make exactly 180 degrees, you may judge your instrument is right; for (by 32 *Eucl.* I.) the three angles of every plane triangle, taken together, is equal to two right ones, or 180 degrees. A *Protractor* too may be tried after this manner, with a triangle on paper: But the chain is adjusted by actual measurement, which must be frequently done, to keep it to the exact length by law established.

If New Beginners would measure the sides of the abovementioned triangles, and after map it, such easy problems would soon lead them to know the nature of lines and angles, both in the fields and on paper.

PROPOSITION VI.

PROB.

To take the Field-Notes of a Survey.

Suppose fig. 5 represents a small farm to be surveyed; where the black lines represents the bounds or mearing of the ground, and the dotted lines is the chaining in taking the lengths of the stations, and off-sets and in-sets. After viewing the

the land, pitch upon some convenient point to begin, as suppose at 1. set up your instrument, and send a man to stand for a mark at 2, through the lower eye-slit next the flower-de-luce cut the marksman with the hair in the opposite sight; the instrument being level, when the needle settles, the south end will cut the bearing of the first station 1, 2, S. E. $89\frac{1}{2}$ degrees, and $269\frac{1}{2}$ in the degrees of the whole circle. Next measure the distance that your instrument is from the bounds, which is 15 links (in-set): Then direct your chainman to chain in a straight line with the marksman, until you come opposite the next angle in the bounds, which is on 15 chains, where there is an in-set of 15 links; then proceed until you come to 17 chains, where you just touch the bounds, there you have (o) for off-sets or in-sets. When you come to the end of the station, which is at 20 chains, you have an in-set of 20 links, all which must be noted down in a field-book for that purpose, in the following manner, or some other convenient way.

The

The FIELD-NOTES of E. B-----r, Esq's Land, set to
G. N-----l, Esq; in D--m--re, near U--g--d, County
of Kilkenny, October 1764.

No Stat. Off-sets, &c.	Chains. and Bearing	Observations.	No Stat. Off-sets, &c.	Chains. and Bearing	Observations.
1	269 $\frac{1}{2}$ SE 89 $\frac{1}{2}$	begins at a Ford.	5	77 $\frac{3}{4}$ NW 77 $\frac{3}{4}$	
in. 0.15	0.00		off. 0.10	0.00	
0.15	15.00		0.00	35.10	through a Bog.
0.00	17.00		0.00	60.00	a Ford.
in. 0.20	20.00		0.20	62.00	crosses the
			0.00	63.00	Bounds.
			in. 0.40	66.00	
2	251 $\frac{3}{4}$ SE 71 $\frac{1}{4}$	Mearing.			
in. 0.20	0.00	'Squire H---y's	6	30 $\frac{3}{4}$ NW 30 $\frac{3}{4}$	
0.15	4.00		in. 0.00	0.00	a small River.
0.15	26.00		1.40	7.00	the Bounds.
0.05	41.00		0.00	8.20	
			off. 0.40	8.20	mearing L--d
3	252 $\frac{3}{4}$ SE 72 $\frac{3}{4}$	Estate.	4.00	10.20	M---tg-----t's
in. 0.10	0.00		0.30	23.00	Estate, in
0.00	7.00		1.00	36.25	U--g--d.
off. 0.30	15.20	crosses the Bounds.			
2.20	15.20		7	354 $\frac{1}{4}$ NE 5 $\frac{3}{4}$	
2.00	21.00				
0.15	33.00		off. 1.40	0.00	
0.00	36.40		0.10	7.10	
			1.30	18.48	
			Closes.		
4	162 $\frac{1}{4}$ SW 17 $\frac{3}{4}$	a Wall mears rest of 'Squire B---r's.			
	41.40				

After

After you have taken the first station, and written it down as in the above field-book, you must then set up your instrument at the point (2), the end of the first station; and if you work with a *Theodolite* you must, through the upper eye-slit and the upper hair in the opposite sight, cut a marksman at (1) the beginning of the station, who you must leave for that purpose, the teller end of the index being first set to the bearing of the station (SE 89;) the diameter N. S. of the *Theodolite* will then become a meridian, and in a line with the needle. If you then turn the index only until you can see through the lower eye-slit a man, or a mark at (3), you will have the bearing of the second station 2, 3, cut by the index on the *Theodolite*, without waiting for the needle to settle, which often occasions delay in windy weather; or you may, if you please, take the box and needle off for good, after the *Theodolite* is set on the first station north and south.

When you have written down the bearing of the second station, which is $251\frac{1}{4}$ degrees of the whole circle, or SE $71\frac{1}{4}$ as may be seen in the above field-book; you then must proceed in measuring the length of your station, and to observe at what

part or distance on the station, that each off-set or in-set is taken, which together with the lengths of the off-sets or in-sets, must be set down opposite each other in the field-book, as may be seen above. On this station there is 20 links in-set at the beginning or at (0); 15 links at 4 chains; 15 links at 26 chains; and 5 links at 41 chains the length of the station. When you have finished the second station, and come up to the point (3) send your marksmen to the point (4); set the index to the bearing of the second station which is S E $71\frac{1}{2}$, then turn the whole instrument until you can see thro' the upper eye-slit the hair in the opposite sight to cut the man left behind at the point (2); and then the instrument is again north and south, and parallel to the position it stood in at the point (2) or beginning of the station. Then turn the index by itself until you can see thro' the lower eye-slit the man at (4) and then you have the bearing of the third station 3-4, equal to $252\frac{3}{4}$ degrees in the whole circle, or S. E. $72\frac{3}{4}$ in the quarter-compass, both which are set down in the foregoing field-book.

When you look thro' the upper slits in the sights from the ending of the station to the beginning,

ginning, it is called a *Back-sight*; but when you look through the lower slits, and from the beginning of the station to its ending, it is then called a *Fore-sight*. A *Theodolite*, or any other instrument without the needle, cannot be used without making back and fore-sights at every station; for it's by the foregoing station that the instrument is still set parallel: but the needle keeping its parallelism throughout the whole survey, whoever works with it, need only make one sight at every station, and that may be taken either backwards or forwards, as the Surveyor shall see most convenient.

Having taken the bearing of the third station, and written it down, as above, you then must proceed to measure its length, and the off-sets or in-sets as they happen. At the beginning or [0] you have 10 links in; and at 7 chains you cross the bounds where you have [0] for off-sets or in-sets; at 15 chains 20 links, you have 30 links off; and at the same you have 2 chains 20 links off; when you come to 21 chains you have 2 chains off; at 33 chains there are 15 links off; and at 36 chains, 40 links, the end of the station, there is [0] off, the station happening to end on the very bounds.

When

When you are come up to the point [4] the end of the station, fix up your instrument, and having set the index to the bearing of the last station which was S. E. $72\frac{1}{2}$, turn the whole instrument until you can see with a back-sight a mark at the point [3] and then the instrument is again north and south, turn the index by itself until you can see with a fore-sight an object at the point [5] and then you have the bearing of the fourth station cut by the index on the large circle, which is S. W. $17\frac{1}{2}$; and the degrees of the circle is $162\frac{1}{2}$. Then measure the length of the station which is 41 chains, 40 links. On this station you have no off-sets or in-sets, the bounds being a straight wall. It is seldom stations happen that have neither off-sets or in-sets, except some that may happen on roads, the center of which being the bounds, are frequently made the station lines.

Being come to the point [5] set up your instrument, and take the bearing of the station 5, 6, as you were directed in taking the foregoing; do so with the 6th station [6, 7,] measuring the lengths, and off-sets or in-sets as they happen, of each station. After the same manner take the bearing

bearing and length of the seventh station [7,1) and when you have come up to the point [1], at which you began, the survey is then finished and closed. The bearings, lengths, and the off-sets or insets of each station in this survey, may be seen in the foregoing field-book.

It must be observed, that as you go round any survey, you must mind to carry your chain, and fix your instrument in going up or down declivities, as well as on level planes, in as horizontal a manner as you can. It is a custom among surveyors, to find the horizontal lengths of their lines, up or down declivities or hills; and the *Content* of any piece or parcel of ground, calculated from notes taken after this manner, is what surveyors call the *Horizontal Content*. Yet whoever will consider the earth to be a globe, and the nature and properties of vertical lines, and vertical planes, with the manner in which field-notes are taken, shall find it no easy matter, to give a true mathematical definition of this *Horizontal Content*; or to tell what plane, or planes of the globe it is.

Though there is nothing but the custom and opinion of surveyors, to establish
the

the use of the *Horizontal Content*; yet, where there is any advantage, or disadvantage, as it is almost become publicly known, between land-lords or tenants, they make their bargains or agreements accordingly: But the chief and best argument for the support of it, is, that no survey can be accurately or nicely made, without introducing such a method into practice.

Since it is the horizontal length of stations that surveyors aim at, any circle or instrument, measuring the angles that these lines make with each other, or any other given line, must undoubtedly be in the same horizontal plane with these lines, or parallel thereto. If any surveyor chaining a line up or down a hill, should fix his instrument parallel to the plane thereof, to discover the horizontal angle that said line makes with another, might as well measure the hypotenuse of a spherical triangle, to come at the quantity of the base or perpendicular. So that to find the *Horizontal Content*, it is absolutely necessary to keep the instrument still level, as well as the chain, which can be done well enough with the eye, or by the swings of the needle. The chain is carried level by holding up the lower end thereof; or
half

half the chain or less: when the steep is great, the best way is to take its elevation, and measure along the slant surface, and then by the following tables, or trigonometry, find the horizontal length of your station.

The fewer stations you make in any survey, the less labour you have, the less chance you have of making mistakes, either in the field-work, or the chamber-work; so that I would recommend it to you, to make your stations as long as you possibly can, without having your off-sets or insets too large. When you have a large off-set, you may find out where it falls at right angles on your station line, by the help of your instrument; but small off-sets may be taken very well by estimation; or by moving one of your pins along the chain at right angles, you may see when it intersects the angle in the bounds, and so discover the point in the station line, from which the off-set must be measured. If you work with a *Circumferenter*, and has a person that can oversee and manage the chaining, yourself may go on before, instead of the marks-man, and lay out your stations to the better advantage: But in this case, you must still make a back-sight, to one of the men at the mark behind;

hind; and as it is the best way when convenient, always to look thro' the lower flits of the instrument, and as near the index as possible, you may screw the box on contrary; or if you change the sights, when you look thro' the lower flits in taking back-sights, the south end of the needle, will cut the direct bearing of each station.

If there should be any object on the lands you are surveying, or on those adjoining, as a house or a tree, which you would be willing to retain in the map, in its proper place; or if there should be a point, or points in the bounds, which you cannot come at with the chain by reason of water, or some other hindrance; the bearing of each object or point must be taken from two different places, somewhat distant from each other, on the same or different stations; which bearings you may note down in the column of observations in your field-book, at the points on the stations they were made. When you are protracting your work, if you lay down these bearings from their proper places, as you would a station, the point where they intersect each other, will give the true place of the object in the map.

When

When you survey with the *Theodolite*, there is but little use in the box and needle but just to find the situation of the ground; and where this is not much heeded, as in small farms, you may take a survey with the *Theodolite* without any needle, thus: Only suppose your first station to be a meridian, and so take the bearing of each station from that supposed meridian as if it was a true one; or if you can guess at a north and south line, you may at the first station set your instrument as near thereto as you can estimate, and so proceed as if you had set it by the needle. The field-notes taken after this manner, will answer as well for calculation, or protraction either, as if they had been taken from a true or magnetical meridian, when nothing but the content of the ground is required. Or by the help of a well-going *Watch*, a surveyor may find the situation of a farm pretty near the truth: For if at the hour of *Twelve o'Clock*, the angle be taken which the *Sun* makes with any one station in the survey, a line may be drawn in the map, making an angle with the same station, like, and equal to this observed, which shall be a meridian, or north and south line to the map.

These are the principal methods made use of in taking the field-notes of single surveys, and where there are many surveys to be made on one and the same estate, the like methods are to be followed, only you are to note down in your field-book, from what station and part thereof, of the survey that is finished you begin for a new survey, and at what part you close. As suppose there was another survey to be taken, to the north of this farm (fig. 5.) and measuring it from the beginning of station 2d to the end of station 3d, then you are to begin for this new survey at the point (2) and close at the point (4). But then you are to observe, that the off-sets on the second and third stations to the first survey, will be in-sets to this new survey, and the in-sets will be off-sets. Thus you may take a great number of surveys adjoining each other without the least confusion; which I think is a better method than to first make a survey of the whole, and after to take the divisions.

After this, or a similar manner, an actual survey of a *County* or *Province* may be made; taking your stations along the different *Roads*; and the various objects as *Castles*, *Churches*, or *Country-Seats*, may be

be taken in, as you chain along, by taking the bearing of each object at two different places on the chaining. Suppose as you chain from N. towards S. (fig. 7.) you observe an object at C, that you would be willing to express in the map; take its bearing at the point B, and note it down, and likewise when you come to the point D, take its bearing there; now it is evident that the situation of the point C, in respect of the other points B and D may be discovered either by *Projection* on the map, or by *Trigonometrical Calculation*; even supposing the points B and D to be on different and distant stations.

PROPOSITION VII.

PROB.

To protract the Stations of a Survey, or make a Map of the Body-of-the-Land.

The common method of protracting the stations of a survey, is by the assistance of lines drawn parallel to each other, at the distance of an inch or half inch asunder. These parallel lines do represent meridians, and by them the *Protractor* is still set parallel at the laying down the bearing of each station.

I shall

I shall here offer a method to protract a map *without parallels*, which I have practised these some years past. By it we escape the errors that may be introduced, and the trouble in making the parallels; for any paper that is large and strong enough will do. Besides it sometimes may happen that parallel-paper may not be conveniently had, with those who would prefer that method in practice.

Here followeth an example in protracting the foregoing field-notes, without parallels.

Fig. 8.

Let N. S. E. W. represent the paper you design to draw your map upon; you must mind to begin in the same quarter of the paper that you did on the land, in respect of the four cardinal points, otherwise your protraction may run off the paper, tho' it be large enough to contain it when you begin in a proper place. You may see by these field-notes that this survey was begun in the north west quarter of the land, so you must begin, on the paper in the same. Lay your *Protractor* nearly parallel to N. S. with its arch towards E. as the first station is easterly; its center being at (1) prick off the bearing of the first station, which is S E $89\frac{1}{2}$ degrees. On this bearing,

ing,

ing, and from the point (1), lay down the length of the station 20 chains, with the scale on the *Protractor*, which will reach to the point (2). Before you stir the *Protractor*, draw a white line, as *a b*, with the protracting pin, of such a length that when the center of the *Protractor* is brought to the point (2) the arch whereof will cut the said line *a b*; but let it not be joined to the station. Now fix the center of your *Protractor* on the point (2) with the bearing of the first station, viz. S E 89; set to the line *a b*; then will the diameter of the *Protractor* be parallel to its former position, and will consequently represent a meridian. The bearing of the second station may be then prickt off as before, which is S. E. $71\frac{1}{2}$ degrees; again on this bearing lay down its length forty one chains which will reach to (3), and without stirring the *Protractor*, draw the white line *c d*, put the center of the *Protractor* on the point (3), and the bearing of the second S E $71\frac{1}{2}$ to the line *c d*, so will the *Protractor* be again parallel to its former position, and will represent a meridian.

The bearing of the third station S E $72\frac{1}{2}$, may be laid down after the same manner, and its length 36 chains 40 links being

being laid down, will give the point (4) which is the extreme east of the survey. You now must turn the arch of your *Protractor* towards the west. If the station 3, 4, be not as long as the radius of the *Protractor*, you must draw the white line *eb*, which is the same thing as to continue the line 4, 3, out westerly, beyond the edge of the *Protractor*. Now put the center of the *Protractor* to the point (4) and the bearing of the third station SE $72\frac{1}{2}$, which must be now considered as if in the opposite quarter, to the line *eb*, then will the diameter of the *Protractor* be again a meridian, and so you may prick off the bearing of the fourth station, which is S W $17\frac{1}{2}$ degrees. Its length 41 chains 40 links, being laid down will give the point (5). Thus you may proceed from station to station until you close the map at the point [1] where you began.

This kind of protraction may be performed by the common *Protractor*, and the notes taken with the *Circumferenter* or whole circle. But as the field-notes are now mostly taken by the four ninties or quarter-compass, if there was a *Protractor* made with four ninties [like fig. 2] two on the inside edge, and two on the outside edge

edge, but numbered contrary as in the figure, I think it would match this kind of protraction better than the common one. In this *Protractor*, the radius may be made a meridian, and the bearings can be laid down to the east or to the west, by the inside ninties; which will be found somewhat convenient when there happens a station to run near the edge of the paper, or when a station is longer than the radius of the *Protractor*; for then you can set it meridian-ways without drawing a *Guide-line* out before it. But the notes taken by the whole circle cannot be protracted by this; and a station near the edge of the paper, may be laid down by the common one, if you lay down the opposite bearing and proceed backwards by turning the *Protractor*.

In protracting a survey, the end of the last station must fall into the beginning of the first, or very nearly; for there must be some allowances made for the inaccuracy of practice, as shall be more nicely considered when we come to calculation. When the map does not rightly close, there must be some mistake committed in taking of the field-notes, or in the protraction itself. After you have thoroughly satisfied yourself, that the mistake is not
com-

committed in the protraction, by protracting the work over again, and that backwards, beginning at the last station, and taking opposite bearings: The question is then, to judge in what station the error was committed; and whether in the chaining or in the bearings. The method I would recommend is this: lay the edge of your *Protractor* or scale on the *ending* of your last station, and on the *beginning* of the first. Then look over the work, and see what station runs *parallel* to the scale, and likewise what station runs *perpendicular*, or at *right angles* thereto. The first you are to examine for a *mistake in the chaining*; the latter for a *mistake in the bearing*.

The most common mistake is a chain; and if you can make a closure, by altering any one station a single chain, you may very well judge your correction is right; but if the work runs wide of a closure, it is probable that the error may lie in some of the bearings, except there be a mistake of a whole change. When you are taking the field-notes, it would be adviseable to cut your survey into two, by running a diagonal line across the ground in the most narrow part thereof, which will
be

be of great assistance in correcting of mistakes; and also to take the bearings both by the whole circle and quarter-compass; this will assist you in finding out a mistake in the bearings. For a station in the N. W. quarter will have the same degrees in the whole circle and quarter-compass; a station in the S. W. quarter the sum of the degrees of the whole circle and quarter-compass will be 180; a station in the S. E. quarter the difference of the degrees of whole-circle and quarter-compass will be 180; and a station in the N. E. quarter, the sum of the degrees of the whole circle and quarter-compass will be 360. While you are in the field, you ought to prove the bearing of each station by this rule, before you would quit the instrument.

If you protract without parallels, you must take care to lay down your angles very nicely; for a small error committed in this point, will increase to the end of the work, and cause a great misclosure: the least inaccuracy may be seen. Whether this be a *Perfection* or an *Imperfection* in the method, I leave to the reader to judge. A *Protractor* might be divided into half degrees, or nicer, to answer this purpose.

PROPOSITION VIII.

P R O B.

To protract the Off-fets and In-fets of a Survey, and finish the Map.

After the stations or body-of-the-land is protracted, the next thing to be done is to lay down the off-fets and in-fets of each respective station, which is done much after the same manner that they are taken on the land. With the scale on the edge of your protractor, mark off the different distances on each station, that the off-fets or in-fets were taken at. From each mark lay down the length of its respective off-set or in-set, at right angles to the station, as they were taken in the field. Join the extreme ends of these off-fets and in-fets, by lines drawn from one to to'ther, and you will have a true *Figure* or *Map* of the bounds of the land.

Suppose you were to lay down the off-fets on the third station (see fig. 5. and the foregoing field-notes) at the beginning lay down 10 links *in-set*; at 7 chains you have *nothing*, the station crossing the bounds at that point; at 15 chains 20 links, lay down 30 links *off*, and 2 chains 20 links *off*;

off; at 21 chains lay down 2 chains *off*; at 33 chains 15 links *off*; and at 36 chains 40 links you have *nothing*, the station ending exactly on the bounds. Join these points, and you have the bounds adjacent to that station; and so of any other station.

When your scale is 40 to the inch, you must reckon every small division on the protractor a two-pole chain, and every five links will be a tenth thereof: For a scale of 20 reckon every 25 links, or half chain, a small division on the scale, and every two links and an half, will be a tenth thereof. If you would reckon every 10 links a small division, or every four-pole chain a large division, on the protractor, every inch then on the scale would represent 8 perches.

When you have the rough draft finished, you may transfer it on clean paper, parchment or vellum, or whatever you design to make a *fair* map on, by fixing it under the rough draft and pricking thro' both, with your protracting pin, at every angular point in the bounds of the rough draft: Join these pricks on the clean paper, with lines from one to the other, and you shall have a true copy of the rough draft.

PROPOSITION IX.

P R O B.

To measure a Map, or to find the Content of a Survey by Protraction.

There are various methods for measuring of maps, but the three following seems to be held in most esteem by practitioners.

Method I. Let the map be divided into triangles, by white or pencelled lines; measure the base and perpendicular of each triangle, with the scale by which the map was laid down; from thence find the content: The contents of all the triangles added together, will be the content of the whole map.

A *small field* may be measured after this manner, by disposing it into triangles, and measuring the bases and perpendiculars with the chain.

Suppose A B C D, fig. 7. was a field in the form of a *Trapezium*, having four unequal sides; this figure is only two triangles, with one common base B D, called the *Diagonal*: Measure from the point B in a straight line towards D, when you come opposite C, measure the perpendicular

cular C P, which suppose to be 5 ch. 35 l. or 11.4 perches, measure on, until you come opposite A, then measure the perpendicular A P, which suppose to be 3 ch. 15 l. or 66 perches; finish the diagonal B D, which suppose to be 9 ch. 45 l. or 19.8 perches. Now if each perpendicular, or their sum 18.0 be multiplied by the diagonal 19.8, you will have 356.40 for their product; the half of which is 178 square perches, or 1 A. OR. 18 P. the content of the field.

To measure a *Square*, *Rectangle*, *Rhombus*, or *Rhomboides*, (in fig. 3.) see the rules in *Axiom II* but they seldom occur in practice.

Method II. You must draw upon paper parallel lines at the distance of half an inch, or an inch asunder: When your map is drawn thereon, that part thereof which is occupied between every two parallels, you must convert into an oblong square, by balance-lines at each end; and then you will have a number of rectangles or long squares, equal in area to the whole map, whose breadths are all equal; and their different lengths and contents, may be found by the scale you laid the map down by: But there are scales peculiar to
this

this method, called the *Scale of Acres* or *Computing-scale*, to which applying the length of each rectangle, you have its content at once in acres and parts.

Method III. If you would divide your paper into *Square Inches*, or *Square half Inches*, by drawing two sets of parallels at right angles to each other, and then protract your map upon this chequered paper; you may come at the content of the map, by reckoning the number of squares contained therein. If you protract by a scale of 40 perches in an inch, then every *Square Inch* will be $40 \times 40 = 1600$ perches or ten acres; if your scale be 20, then every *Square-inch* will be only 400 perches or 2A. 2R. If the squares be only *square half inches*, then each will contain only the fourth part of the *square inch*. There is usually made a *square Inch-horn*, and that divided into 100 little squares: By this inch-horn you are to measure those parts of squares, that may be broken, by the bounds of the map passing thro' them.

The two last methods may as well be used after the off-sets are put to the map as before. My design was not to enlarge upon these methods of protraction, so I
must

must refer the reader to other authors who treats more fully of them: But I shall here give the description of an instrument by which we can measure a map in a moment or two, surprisingly near the truth.

I got a piece of good glafs, about eight or nine inches long, and six or seven inches broad, divided into small oblong squares, of eight tenths of an inch by five, like unto fig. 10.

By laying this instrument (which I think may be called a *Computer*) upon a map, you can tell with very few figures, sometimes with the eye only, how many squares are contained in the map, and consequently how many acres. When the map is laid down by a scale of 20 perches in an inch, then each square will be 16 perches by 10, or one acre; when the scale is 40, then each square will be 32 perches by 20, or four acres; if the scale was 80, then each square would contain 16 acres: By knowing the scale, and the size of each square, it's easy to determine how much of the map each will cover; if the scale be 10 to the inch, then the above squares will each cover 8 perches long, and 5 broad of the map, which is 40 square perches

perches or one rood: And so of any other sized squares; tho' I think the above is the best size for this instrument.

All the intire squares within side the map, may be reckoned and set down with the pen, and the broken acres may be computed or balanced with the eye, various ways: Or the whole map, may by balancing with the eye, be found equal to a parallelogram of acres, and then the content may be discovered in the mind without making one figure.

This instrument would be useful to Surveyors in finding out a gross error; and it may be used either before or after the off-sets are protracted. I laid it on the map without the off-sets, drawn from the field-notes already given, at 20 per inch, and in a hasty manner found the content thus:

$$\begin{array}{r}
 81.0 \\
 0.9 \\
 15.5 \\
 2.0 \\
 \hline
 99.4 \text{ Acres.}
 \end{array}$$

It would likewise be useful to gentlemen or others, not very well skill'd in surveying, to measure a map or part of a map,

map, that they were willing to know the content of nearly, without making an actual survey. It is very easily used; by shifting it backwards and forwards, there must be as many lines of the map made to coincide with these on the *Glass*, as is possible: But a few trials, in measuring a map, will be more instructive than a whole chapter of directions.

It appears that there might be an instrument contrived, somewhat of this nature, which by looking through it, would discover the content of a piece of ground, pretty near the truth, especially a plain or level piece of ground; but we shall pass this by.

If the large squares were divided into smaller ones, and the lines distinguished by different colours, this instrument might be used as the scale of acres: The spaces betwixt their parallels might be numbered, and their contents computed in acres and parts, which added up together, will give the content of the whole map. *Glass* is better for this instrument than horn; for it can be made larger, and will keep the paper vastly better on a flat than horn would: But when the map is larger than the instrument, it then may be measured by two or more operations.

rations.---I would not here be understood but that the design of this instrument was only to discover the content of a survey in a cursory manner; nor are those other mechanical methods, tho' somewhat superior to this, without their constant inaccuracies: But, from these, we shall now pass to those methods of CALCULATION, by which we can come at the content of any piece or parcel of land, without any mechanical operation whatsoever; but what cannot be avoided, that is, the taking the field-notes, or *Dimensions* of the ground: *Methods* by which, if these dimensions be once taken with care and exactness, we can attain this content required, by an *arithmetical operation* of figures, to the greatest nicety possible.

PROPOSITION X.

P R O B.

The Bearing and Length of a Station, being given to find the Difference of Latitude and Departure.

I shall not here enlarge upon the different instrumental methods there are or may be for answering this problem; for in my opinion, instrumental calculations are too much
in

in vogue already amongst Surveyors. The use of the tables, which writers has heretofore given us for this purpose, and is held in most esteem, do scarcely differ any thing, from the common trigonometrical calculations, which indeed are very tedious and troublesome: This has induced me to make the following *Tables of Difference of Latitude and Departure*, to the description and use of which, in answering this problem, I shall intirely confine myself.

The Description and Use of the Tables.

In the first column of these tables is to be found, the length of the given station in two pole-chains, from 6 to 50. The bearings with their complements, are to be found along the top of each page; and in the common angle of meeting, may be found the difference of latitude and departure. The number found under the *Bearing* is the difference of latitude, and is the northing or southing of the station: But the number found under the *Complement* of the bearing, is the departure, and so must be the easting or westing of the station. The bearings as may be seen,
are

are set down in degrees and quarters of degrees. Tho' I chose to set down the lengths of stations in the first column, in two pole-chains, yet the difference of latitudes and departures are in four pole-chains, or links. Take the following examples to illustrate their use more fully.

EXAMPLE I.

When the length of the station is an exact number of two-pole chains: suppose 41 chains and the bearing to be south east $71\frac{1}{2}$ degrees.

Look for $71\frac{1}{2}$ degrees on the top of the page, and for 41 chains in the first column, and in the common angle of meeting you'll find 6.51, which is the difference of latitude or southing of the station; and the next number to it, under $18\frac{1}{2}$ degrees, the complement of the bearing, you will find 19.45 for the departure, and is the easting of the station in four-pole chains and links.

EXAMPLE II.

When the station consists of chains and links: Suppose the station N. W. $8\frac{1}{2}$ 26 chains 11 links.

As

As the numbers in the first column are two pole-chains, and is double the number of four pole-chains, contained in any station; so if you are to find the difference of latitude and departure for any small number of links, you must find a number double to the given number of links in the first column; and opposite to it in the same line under the given angles you will find the difference of latitude and departure in links only, and decimals of links. To find the difference of latitude and departure for the above station; first find $8\frac{3}{4}$ the bearing or angle along the top of the pages, and then find 26 chains in the first column, and in the angle of meeting you have 12.58, but as there are 11 odd links, you must find its double (22) in the first column; and in the same line under $8\frac{3}{4}$ you'll find 10.87, or nearly 11 links, which added in your mind to 12.85, you then may write down the sum 12.96, which is the difference of latitude for the whole station. If you add 1.67 links, which you may call two links, found under the complement of the angle, and opposite 22, and is the departure of the 11 odd links: I say, if you add these two links to 1.98 chains, the departure of 26 two pole-chains,

chains, found next 12.85, you will have 2.00 chains for the whole departure.

When the number of odd links exceeds 25, the double cannot be found in the first column, you must then take the number of links from 50, the links in a two-pole chain, and the difference of latitude and departure for the remainder, taken from the difference of latitude and departure of the number of chains next greater than the length of the station, will be the difference of latitude and departure for the whole station---Suppose the station N.W. 36 $\frac{1}{4}$ 29ch. 33 links. Which wants only 17 links of 30 chains. Then

		D.L.	Dep.
Opposite 30 chains -	} And under $36^{\circ}\frac{1}{4}$ and complement you'll find -	12.10	8.87
Opposite 34 the double of 17 - -		.14	.10
The difference of latitude and departure for the whole is		11.96	8.77

Or if the lengths of stations was still taken in *two-pole chains* and *tenths*; that is, at every 5 links, then this operation might be always done by addition; which method I would recommend, lest using addition and subtraction thro' the tables, might some times be a means of introducing mistakes: and there are very few, stations,

tions, except the last, or closing station, but what may be made to consist of an exact number of two-pole chains, by continuing out the station line beyond the man who stands for a station mark, to the end of the chain; or the station may be made to end at an even chain before you come up to the mark. Either of these may be practised without any sensible error, when the station is chained fair. Tho' I think there need not be much pains taken abroad to make the stations consist of a number of chains, since it's so easy to find by these tables, the difference of latitude and departure for chains and links, and that without making a figure; or even to *half links* either, for every odd number in the first column, is the double of another, having an odd half link: So if you were to find the difference of latitude and departure for 14½ links, and at any bearing, look for 29, the double of 14½, and under the bearing given, you will find the difference of latitude and departure; and so for any other number having an odd half link. But there is hardly any necessity for this, it being nice enough to take the lengths of stations, to links only. If these odd numbers be considered as chains, we can, by
half-

halving their difference of latitude and departure, find the difference of latitude and departure for any number of *chains* and *half chains* up to $24\frac{1}{2}$, the double of which is 49, the greatest odd number found in the first column.

Example. Suppose the station S. E. 9 degrees, $16\frac{1}{2}$ chains, or 16 chains 25 links; find 33 in the first column, the double of $16\frac{1}{2}$, and half (16.30) its difference of latitude under 9 degrees, will be 8.15, the southing of $16\frac{1}{2}$ chains, and half (2.58) the departure, for 33 chains will be 1.29, the easting of this station of $16\frac{1}{2}$ chains; and so of any other station of chains and half chains to $24\frac{1}{2}$. These are the chief examples, tho' sometimes the following may occur.

EXAMPLE III.

When the length of the station is not to be found in the first column, but is less than 6, or greater than 50 chains: Then let the right hand figure of each number in the first column, be supposed to be pointed off for a decimal, the numbers then will be chains, and tenths of chains, and so the difference of latitude and departure
for

for chains and tenths of chains under 6, may be found by only removing the decimal points. Suppose the station was S. E. 74° 4 ch. 15 li. or 4.3 chains, (for every 5 links is a tenth of a two-pole chain.) Look for 4.3, or 43 in the first column, and under 74 degrees you will find 0.59 links for the difference of latitude, and next to it you will find 2.07 for the departure, by removing the decimal points. The figure 6, the first in the column may be six tenths of a chain, or 30 links, and so the last, will be by pointing off the 0, be five chains; and so of all the intermediate numbers. When the length of the station is above 50 chains, and an even number, then the latitude and departure of half the length found in the first column, being doubled, will give the difference of latitude and departure of the whole station: Suppose the station S. W. $77\frac{1}{2}$ 66 chains.

Then you will find in the	D.L.	Dep.
tables for 33 chains - -	3.50	16.13
Which multiplied in your		
mind by -		2
Will give for 66 chains	7.00	32.26

K

But

But when the length of the station is an odd number of chains, the difference of latitude and departure is found by adding together in your mind, those of the two numbers, found together in the first column, which make up the length of the station when added: Suppose the length 67 chains, the bearing as in the last example. Then

			D.L.	Dep.
Opposite	-	33	} Chains you will find {	3.50—16.13
Opposite	-	<u>34</u>		<u>3.61—16.64</u>
And by adding	{ 67 chains			7.11—32.74
you will have for				<u>7.11—32.74</u>

SCHOLIUM I.

After the same manner by these tables, having the length of a station along the slant of a hill, and the elevation thereof above the horizon, (which may be found by observation,) we may find the *horizontal length* of the station. Suppose the length of the station to be 27 chains, and its elevation, or declivity, on the side of the hill, to be 14 degrees, then under 14 degrees, and opposite 27 chains, you will find 13.10, for the horizontal length of the station; and the number 3.26 next to it, under

der the angle's complement will be the perpendicular height thereof.

SCHOLIUM II.

If there was an instrument so nicely made as to give the true quantity of an angle in the field to *half a quarter of a degree*, the difference of latitudes and departures of stations, whose bearings were taken by such an instrument, could be found by these tables, and that too, I may say, by inspection only, thus: Find the two angles next each other in the tables, differing one-fourth of a degree, to which the given angle shall be an arithmetical mean; then an arithmetical mean between the difference of latitude under these angles at the given length, shall be the difference of latitude for the given angle, to half a quarter of a degree. The same may be said of the departure.

Example: Suppose the station S. E. 71° degrees, a quarter and an half, or $71^\circ 15'$ degrees, 41 chains. Now opposite 41 chains, and under $71^\circ 15'$ you will find 6.59, and under $71^\circ 15'$, 6.51; a mean between these numbers, which is 6.55, will be the difference of latitude; and the departure
you

you will find to be 19.43, which is a mean between 19.41 the departure to 71 $\frac{1}{2}$, and 19.45 the departure to 71 $\frac{3}{4}$.

When I speak above of the nice make of an instrument, I do not mean to doubt that an instrument could be made or divided in such a manner as to strike out to the eye, the circle into parts of half quarters of degrees; instead of that, I do believe an instrument could be, and is commonly made, that would shew every two or three minutes of a degree very distinctly, by a *Nonius* for that purpose. But the case is, after all, from the whole structure of the instrument, whether the quantity observed will be within half a quarter of a degree of the *true* and *exact* quantity of the angle. To find how much the general run of instruments do vary from the *truth* in taking the quantity of angles, it would be necessary to measure one and the same angle by several and various instruments, and even by different hands; for it is not unfrequently the case for two Surveyors to differ about the quantity of an angle, observed at the same time and by the same instrument; especially a *Circumferenter*. But all the inaccuracies arising from practice, which in some measure cannot be avoided,

avoided, the judicious *Practitioner* will easily correct and amend, in fitting and preparing his work for calculation; which in effect is nothing but the alteration of the *Bearings* and *Lengths of the Stations*, so as to make them as nearly mathematically *true* as is possible. To advance rules for that purpose, shall be our next inquiry; and for the foundation of which, we shall first lay down the two following *Lemmas*.

LEMMA I.

In taking an angle in the field, whatever be the small divisions of a circle, that the angle is taken to, there may be an error of half one of those divisions, under or over the true quantity of the angle, supposing the instrument by which it is taken, exactly right and truly graduated.

This needeth no demonstration:

Surveyors in taking the quantity of their angles, generally take them no nicer than to quarters of degrees; hence there may be an error of half a quarter of a degree under or over the true quantity of the angle: Besides these errors, there
may

may errors arise from the structure of the instrument; for it cannot be supposed that any instrument, finish'd by the nicest hand, can be mathematically true; and when those instrumental errors, tho' small, joins with those from observation, they may make an error somewhat considerable. It is true, they sometimes may destroy each other, and then the angle observed, may be said to be the true one.

LEMMA II.

In measuring the lengths of lines in the fields, there may be an error committed of half a link in every ten chains or twenty perches, supposing it to be measured with common care and exactness.

This is proved by experiments.

To find out what error might be committed in chaining the length of a station, I have made several trials, by measuring the same lines over and over, and that in different kinds of ground; and I am satisfied that half a link may be allowed for an error in every ten chains or twenty perches, and that in tolerable good chaining; though I must own, in very nice chain-

chaining, in very even ground, the errors committed are not worth speaking of: But I am afraid that too little of such chaining is practised in common by Surveyors; and that there is more chaining done, that ought to have a link or even more, allow'd for an error in every ten chains, than is otherwise. It is very easily to err an inch in laying down a chain, without great care; and careless chaining commonly makes the stations of a survey contain more than they ought, and the area too, the chain being mostly kept slack, and still varied to and fro from a right line. These being premised and allowed of, we shall come to the following proposition.

PROPOSITION XI.

PROB.

To find what may be the Error in the Difference of Latitude and Departure of a given Station, arising from the Inaccuracy of Practice.

Let the right-angled triangle ABD , (fig. 9.) represent a station AB , with its difference of latitude and departure. If the

the angle A be the bearing, then will the leg AD be the difference of latitude, and the leg BD the departure; but if the angle at B be the bearing, then will the leg BD be the difference of latitude, and DA the departure. Let the small angle BAb , represent the error committed in taking the bearing, which may amount to half a quarter of a degree, or $7\frac{1}{2}$ minutes (by Lem. I.); and the small part Be , or Eb the error committed in chaining in proportion to the whole line AB , or Ae ; as 0.5 is to 5.00, (by Lem. II.) and let ea , bd , and Ec be drawn parallel to BD , and Bno , and res , parallel to DA .

Case I. Suppose AB to be the true bearing and length of a station, and Ab the same, found by observation.

Now it's plain, that instead of the triangle ABD , we shall have by observation the triangle Abd , so that there is ^{an} ~~no~~ error of the quantity nb , by which the leg BD is encreased, and an error of the quantity Bn , by which the leg AD is decreased: and the contrary may be supposed, if Ab be the true distance and bearing, and AB that found by observation: But when the angle at A is very small, Dd may be supposed equal to (0).

Case

Case II. Suppose the true length and bearing of a station to be Ae , and that found by measurement to be AB , the bearing exact.

Now it's plain that the leg ea is increased by the error, rB , and that the leg Aa increased by the error $r\frac{1}{2}$ or aD , and the quantities, or errors by which each leg is increased, are in proportion to the legs themselves, that is, $B:r::ea::re:Aa$, and as Be is to Ae .

Case III. Suppose Ae , the true bearing and length of a station, and Ab the same, found by observation. This supposes a compound error, both in chaining and bearing, and that the error in the bearing, increases the smallest angle in respect of the bearing and its complement. Here we may see that whilst the leg Aa is increased to AD by the error in chaining, as in the last case, it shall at the same time be brought back to Ad by the error in the bearing, as in Case I. Therefore the leg Aa will be increased by the quantity $re - Bn$, or decreased by the quantity $Bn - re$; but re is greater than Bn , when the angle at A is small; and Bn is greater than re , when the angle is near 45 degrees; for they become equal when the angle is about

25 degrees: but at the same time the leg
 e a will be increased to d b, by the error
^{a b} $bs = \cancel{B}n + Br.$

Case IV. Suppose A E the true distance
 and bearing, and A B the same, found by
 observation; this supposes the error in the
 bearing to decrease the smallest angle.
 Now it is evident that the longer leg A c,
 is increased by the error B o, or D c, and
 the shorter leg decreased by the error E o.
^{a b} But $Bo = Bn + re$, (for $re = no$) and $Eo = \cancel{B}n$
 $- Br.$

These errors are easily found in num-
 bers by the following tables, for a station
 of any given length and bearing. The
 errors for Case I. is found by considering
 Scholium II. to Prop. X. and for Case II.
 by Example II. to same Prop. by finding
 the difference of latitude and departure for
 (Be) the error in the chaining. The com-
 pound errors for Case III. and IV. are found
 from these. And these errors, both simple
 and compound, for the same angle, are
 proportional to the lengths of the stati-
 ons.

Here

Here followeth a table of errors in links and decimals, according to the foregoing Lemmas for a station of 30 two-pole chains, and for the different angles and their complements, under which they are placed.

$BAb = \frac{1}{2}$ Deg. Error in Bearing.	0 2	0 12	0 23	0 32	0 42	0 45	$Be = 1.5$ Links Error in Chaining.
	88	78	67	58	48		
$bn =$	3.2	3.1	3.0	2.8	2.4	2.3	Error in short leg } Case Error in long leg } I.
$Bn =$	0.0	0.7	1.4	1.7	2.2	2.3	
$Br =$	0.0	0.3	0.6	0.8	1.0	1.0	Er. in shorter leg } Case Er. in longer leg } II.
$re =$	1.5	1.5	1.4	1.3	1.1	1.0	
$bs = (bn + Br)$	3.2	3.4	3.6	3.6	3.4	3.3	Er. in shorter leg } Case Er. in longer leg } III.
$ad = (Bn + re)$	1.5	0.8	0.0	0.4	1.1	1.3	
$Eo = (bn - Br)$	3.2	2.8	2.4	2.0	1.4	1.3	Er. in shorter leg } Case Er. in longer leg } IV.
$Bo = (Bn + re)$	1.5	2.2	2.8	3.0	3.3	3.3	

COROLLARY I.

From hence we may draw the following rules for altering the legs of stations in correcting of surveys.

RULE I.

When the bearing, or angle, is either great or small; or when the difference of latitude and departure are found in the
be-

beginning of the tables, then the shortest leg may be increased or decreased by any quantity, not greater than 3.2 links, and the longest leg increased by any quantity not greater than 1.5, or rather two links.

R U L E II.

When the latitude and departure is found about the middle of the tables, or when the angle is about 20 degrees under or over 45 degrees, then the shortest leg may be increased by any quantity not greater than 3.6, or rather four links, and the longest leg left unalter'd, which is when the error in the bearing increaseth the angle opposite the smallest side: But when the contrary, the longer leg may be increased by any quantity not greater than 3 links, and the shorter leg decreased by 2 links.

R U L E III.

When the difference of latitude and departure is found in the latter part of the tables, or when the bearing is about 45 degrees, then either of the legs (they being nearly equal) may be increased or decreased by any quantity not greater than
three

three links, and the other leg by 1.4 link : But when one leg is increased, the other must be decreased.

N. B. The numbers or errors in these rules, are for stations of 30 two-pole chains: But they can be easily changed to any other length, by altering them in the same proportion, as is the stations.

These rules supposeth that the chaining makes the length of a station always more than truth, when errors are committed, which in my opinion is generally the case. But when a Surveyor hath reason to think otherwise, he may alter the rules to his opinion, not only in respect to this point, but in respect of the quantity of the errors.

COROLLARY II.

From what has been said, we may see the absurdity of those who would be for taking the lengths of stations, or their difference of latitudes and departures to half links, or decimals; when perhaps at the same time, they are not within three or four links of the truth: and this was the reason why I did not run out the following tables to decimals of links; for
it's

it's absolutely needless, to retain decimals in latitudes and departures of stations, until the angles can be taken vastly more nice than is done in the present practice.

PROPOSITION XII.

THEOREM.

In any Survey, or Piece of Ground laid out into Stations, all the Northings taken together, are equal to all the Southings; and all the Eastings taken together, are equal to all the Westings.

This is evident from the 9th and 10th definitions.

By this Prop. we come to judge of the correctness of a survey, or whether there was any error, or mistake committed in taking the field-notes: For if the sum of the northings, be equal to the sum of the southings, and the sum of the eastings equal to the sum of the westings: we conclude the work is right. And for fact, if the field-notes of a survey could be taken mathematically true, these numbers would always exactly agree. But from what has been laid down in the foregoing Prop. we

we need not wonder why these numbers so frequently disagree, as they do almost in every survey, though taken with the utmost care and exactness. These disagreements must be adjusted, and the above mentioned sums made equal, before the work is fit to be calculated; and this is performed by altering the difference of latitude and departure, of some of the stations according to the rules given for that purpose. The Surveyor must well consider in which of the stations, and by which of the rules, he is to correct, *so that the aforesaid sums shall become equal by such correction.* It requires some judgment to correct a survey properly; about this I have heard many complaints, nor have I met with any method as yet, that was founded in geometrical reasoning. Some Surveyors I have seen correct their work all in one station: others dividing the errors amongst all the stations equally, and without distinction. But the skilful Surveyor will consider his stations, both in respect of their lengths, and quantity of their angles: and will likewise consider which was taken with most accuracy; so that he may know which he shall correct his work for, errors committed in bearings or chainings. Tho' the
work

work itself will in a great measure shew that, for if the two greatest of the aforementioned sums, disagree more than the two smallest, and the disagreement not very considerable, then of course the work must be corrected for errors committed in the chaining; but if the two greatest sums come near each other, whilst the two smallest sums differ considerably, then the work must be corrected for errors committed in the bearings, and that in stations with small angles: though the errors are generally compounded of both, but most considerably in the bearings. Hence the two smallest sums, or I may say the two shorter sides of the circumscribing Parallelogram, ought to differ more than the two larger, (which is commonly the case,) for the smallest sums, or sides are made up of the shorter legs of each station, and the shorter leg in a right angle triangle, always suffers a greater change than the longer leg, by the least alteration in either of the oblique angles.

Take

Take the following EXAMPLES.

EXAMPLE I.

As in the Field-Notes already given.

St.	The N. S. E. and W. as found in the Tables.				The N. S. E. and W. corrected.			
	N.	S.	E.	W.	N.	S.	E.	W.
1	----	0.09	10.00	----	----	0.10	10.00	----
2	----	6.51	19.45	----	----	6.55	19.45	----
3	----	5.45	17.57	----	----	5.50	17.57	----
4	----	19.90	----	6.37	----	19.90	----	6.38
5	7.00	----	----	32.25	6.94	----	----	32.25
6	15.68	----	----	2.33	15.68	----	----	9.33
7	9.43	----	0.95	----	9.43	----	0.94	----
	32.11	31.95	47.97	47.95	32.05	32.05	47.96	47.96

EXAMPLE II.

1	----	4.85	8.75	----	----	4.87	8.75	----
2	----	5.08	----	0.48	----	5.08	----	0.46
3	----	3.54	5.93	----	----	3.55	5.93	----
4	----	6.57	----	2.42	----	6.57	----	2.41
5	----	7.89	1.30	----	----	7.90	1.31	----
6	3.93	----	----	17.57	3.90	----	----	17.57
7	7.98	----	0.52	----	7.98	----	0.54	----
8	0.42	----	----	2.46	0.41	----	----	2.46
9	6.76	----	1.83	----	6.76	----	1.84	----
10	8.97	----	4.52	----	8.92	----	4.53	----
	28.01	27.93	22.85	22.93	27.97	27.97	22.90	22.90

The four first columns in each example, mark'd N. S. E. W. contain the northings, southings, eastings, and westings of their respective stations. The other four columns mark'd N. S. E. W. in each Example contain these numbers corrected according to the Rules given in the foregoing Proposition.

position. In the first Example the sum of the northings is 32.11, and the sum of the southings 31.95, hence these sums, which are less than the sums of the eastings, or westings, differ 16 links, whilst the other sums differ only 2 links, therefore the corrections ought to be made in the bearings, and that too in stations having small angles.

When the sums of the northings and southings, or eastings and westings differ so much, that the difference cannot be made up by a correction according to the foregoing Rules, it must be supposed there was some mistake or other committed in taking of the field-notes. To help to discover which, I have already laid down Rules in the methods of protraction, and it will be much more plain and easy for beginners to find out a mistake thereby, than in the methods of calculation. If there be a mistake committed of a chain, or so, in any station that hath a high, or low bearing; then one side of the work shall close, or agree pretty well, whilst the other side differs widely: but if the like mistake be committed in any station, whose bearing is near 45 degrees, then both sides of the work shall nearly differ equally alike.

alike. In this case the Surveyor is to find the *difference* of the northings and southings, and *difference* of the eastings and westings, and whatever station hath its difference of latitude, and its departure nearly in the same proportion of the above *differences*, (allowing for the common inaccuracies of practice) a correction must be made in that station, by adding a chain thereto, or taking a chain therefrom, which ever shall make a closure in the work, though it sometimes may happen that a survey shall have two, or more stations, in either of which a correction may be made for a closure ; and to know which station must be corrected, either the memory of the Surveyor and Chain-man, or a second measurement can only determine. But if there can be no station found that will make the work close by the alteration of a chain, (which is the most common mistake,) then the bearings must be examined: though it may be a misclosure compounded of more mistakes than one, and to attempt chamber rules for to correct compound mistakes, would certainly be a most ridiculous undertaking ; for even in single mistakes, the most skillful should scarcely give in a survey from a bare speculative correction, with-

without first proving it on the ground. But when the work is so erroneous, as not possibly to admit of a correction within doors, the stations must be examined over again, both their bearings and lengths, until it be discovered in which the mistakes were committed.

It may not be improper here to observe, that a survey may have such hidden mistakes as shall balance each other, as for example; if a station should be made by mistake, a chain too long, and another nearly parallel thereto, and in the opposite quarter, should likewise be made a chain too long, then there will be a closure in the work; or an error in some of the bearings may have the same effect in making a false closure. So that unexperienced hands, should not be too forward in pronouncing their work to be absolutely free from mistakes, though to all appearance it closes well.

After the work is properly corrected, that is, the northings and southings made equal, and the eastings and westings made equal; the work is then, and not till then, fit to be calculated. Though some Surveyors, when there is not a proper closure in their work, do cast it up by what they
some,

call the *Four Areas* : but it is very troublesome, ungeometrical, and will not give the true content of the survey. I shall now propose a *new method of Calculation*, which is different from any of these methods already given to the public.

PROPOSITION XIII.

THEOREM.

1. *If the Content of the angular Spaces, which lie between the circumscribing Parallelogram, and the Stations of the Survey be taken from the Content of the circumscribing Parallelogram, the Remainder will be the Content of the Survey.*

2. *The Contents of the angular Spaces, are equal to the Sum of all the direct Semi-rectangles, abating the Sum of all the indirect Semi-Rectangles ; that is, when the Latitudes of those Stations, which lie between the North and West Extremes, and North and East Extremes, are measured from the extreme North ; and those which lie between the South and East Extremes, and South and West Extremes, are measured from the extreme South.*

DEMON-

DEMONSTRATION.

1. Let the figure 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, represent the Body-of-the-land, or stations of a survey, (fig. 6.) and A B C D, its circumscribing parallelogram: now it is evident that if the angular spaces $A W_1 2 N A + B N_4 5 6 E B + C E S C + D S_9 W D$, be taken from the circumscribing parallelogram, A B C D, the remainder will be the map or survey, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

2. The angular space at A is equal to the semi-rectangles $A W_1 R + R_1 2 L + L_2 N$, which are the semi-rectangles to the tenth, first, and second stations. Though the first station 1, 2, is an indirect one in respect of its difference of latitude; yet the semi-rectangle taken from the extreme north, or south, will be direct: But if it was taken from the extreme east or west, it would then become an indirect semi-rectangle. The angle-space at B, is made up of the semi-rectangles $N O_4 + g_5 6 c + c_6 E B - g_5 4 O$, which are the semi-rectangles to the third, fifth, and sixth stations, abating that to the fourth station, it being indirect: But if the semi-rectangle to this fourth station was measured from

from the extremes east or west, it would then be a direct one. The angle-space at C is equal to the semirectangle to the seventh station only, this station reaching from the extreme east, to the extreme south. And the angle-space at D, that is the figure DW 9 S, is made up of the semi-rectangles to the eighth and ninth stations, they just filling up the same space, *Q. E. D.*

PROPOSITION XIV.

PROB.

To find the Content of the Body-of-the-land of any Survey, by Calculation.

When we once know the bearing and length of each station in a survey, we can find the difference of latitude and departure, by the following tables, or by trigonometry, &c. We shall now suppose the difference of latitude and departure of every station in this survey (fig. 6.) to be known in numbers, as taken from the tables and corrected; and let each be noted by the letter annexed to it in the figure: that is, the northing of the first station, *viz.* 2T we shall call a, and its easting 1T we shall call z; the northing of the second

second station, $2L$ let $=b$, its easting $LN=y$; the southing of the third station, $O_4=d$, its easting $NO=u$, and so of all the other stations: Then by the foregoing *Propositions*, and from the nature and properties of the figure, the following method for finding the content, may be deduced.

No of Stations.	Northings.	Southings.	Eastings.	Westings.	Latitude of each Station from extreme N. to the extreme E. & W.	Lat. from ex. S. to ex. E. & W.	The Sums of every two Latitudes next adjoining.	The double Semi-rectangle of each Station: Or the Products from the Sums of every two Latitudes, multiplied into their opposite E. & W.
1		a	z		b		$2b-a$	$+z \times 2b-a$
2	b		y		0.0		b	$+y \times b$
3		d	u		d		d	$+u \times d$
4	e		w		$d+e$		$2d+e$	$-w \times 2d+e$
5		b	t		$d+e+b$		$2d+2e+b$	$+t \times 2d+2e+b$
6	k		s		$d+e+b+k$	m	$2d+2e+2b+k$	$+s \times 2d+2e+2b+k$
7		m		r		0.0	m	$+r \times m$
8	n		x			u	n	$+x \times n$
9		p		f	$b-a+g$	$n+p$	$2n+p$	$+f \times 2n+p$
10	q		i		$b-a$		$2b-2a+g$	$+i \times 2b-2a+g$
$=S$ sum of this Col.								

Meridional Breadth.

Parallel Breadth.

$$\left. \begin{array}{l} \text{Then } b-a+g+p+u=AD \\ \text{Or } d+e+b+k+m=BC \end{array} \right\} \times \left\{ \begin{array}{l} i+z+y+u+t+s-w=AB \\ \text{or } r+x+f=CD \end{array} \right\} = \frac{S}{2}$$

equal the Content of the Survey.

In the practice of this method, there are three problems that always occur, which require somewhat of further explanation.

PROB-

PROBLEM I.

To find the greatest extreme, North, South, East, or West.

After the paper is ruled for the calculation, and the northings, southings, eastings and westings are fixed in their proper columns, the next thing to be done is to find out the four extreme points. Mr. BURGH, in his method of calculation, uses a *Criterion*, though I never saw it used in practice by any Surveyor; for an experienced hand will at the first cast of his eye, discover the greatest extreme point. A few examples will make it easy; suppose the extreme points N. S. E. and W. in Example II. (page 89) were required; which is as complicated a figure as could be well met with, in respect of the eastings and westings, there being so many indirect stations therein. First, as all the stations from the beginning to the 5th runs south, and no other southing station after; this 5th station, or 7.90 must be the extreme *Point South*, and by the same reasoning the 10th station, or 8.92 will be the extreme point north. But for the extreme E. and W. you may see that the first station takes you

N

a good

a good ways to the east, and the two preceding stations, the 9th and 10th likewise brought you easterly, but the second station brings you little back to the west, and the third station brings you a good deal to the east; but the 4th station takes you again somewhat to the west, and the 5th again a little to the east; but the 6th takes you off intirely to the west; so that from the whole, the 3d station, or 5.93 is the greatest extreme east. If the westing of the second station, had been greater than the easting of the 3d, then the first would have been the extreme point; or if the easting of the fifth station, had been greater than the westing of the 4th, then the 5th station would have been the extreme point; but as they are not, the third station must be, and is the extreme east. After this, it's easily perceived that the 8th station, or 2.46 is the extreme point west. If the easting of the 7th station, had been greater than the westing of the 8th, then the 6th station would have been the extreme point. By this method of reasoning the extreme points N. S. E and W. in any other survey may be found.

PROBLEM II.

To find the Latitude of each Station in any Survey from the extreme Points, North and South.

When you have found the station which is the greatest extreme N. in a line with it write (o) in the column mark'd L. N. which column contains the latitude of each station from the north extreme, to the extremes E. and W. do so with the extreme S. write (o) in a line with it in the column mark'd L. S. which contains the latitude of each station from the extreme S. to the extremes E. and W. Now beginning at each of these extremes N. and S. that is at (o) in each column of latitude, you must still *add* the northings, and *subtract* the southings, to find the latitude of each station to the extreme point west; but you must still *add* the southing, and *subtract* the northing, to find the latitude of each station to the extreme point east. When the latitude of every station is found, and placed in their proper columns, the next thing to be done is, to add every two latitudes next each other, and put down their sum in a line with the latter station, in the column

column mark'd L A, and each sum, or number in this column is the length of a rectangle, which is double the semi-rectangle of each station. It is no matter at which two latitudes you begin, so you place their sum in a line with the latter, or succeeding station: but we generally begin by adding the latitudes of the first and last stations together, and placing their sums in a line with the first station; and then add the 1st and 2d, and place it in a line with the 2d, then add the 3d and 2d, then the 4th and 3d, and so on. When this column is fill'd, each number must be multiplied by its corresponding easting or westing, (per Axiom II^o) and their products, in a line, must be set down in the column mark'd D S, containing the *Double-semirectangle* of each station. If the easting or westing be *direct*, then its product must be mark'd with the affirmative sign [+]; but if it be *indirect*, then the product must be mark'd with the negative sign [-]; and the sum of all the affirmatives, abating the sum of all the negatives, will be the content of the *angular spaces*.

PROBLEM III.

*To find the Length of the Sides of the
circumscribing Parallelogram.*

From the sum either of all the northings, or of all the southings, subtract the sum of all the northings and southings of those stations that hath indirect difference of latitude; and the remainder will be the meridional breath of the survey: or one side of the circumscribing parallelogram. Likewise, if from the sum either of the eastings, or of the westings, the sum of both the eastings and westings that are indirect therein be taken, the remainder will be the parallel breath of the survey; and will be the other side of the circumscribing parallelogram.

If the latitude of the extreme east, both from the north and south extremes; or either the latitude of the extreme west, both from the north and south extremes be added together, the sum will be the *Meridional Breath*; and these numbers found in their proper columns always next each other, if equal, will be a proof to so much of the work.

The length and breath of the circumscribing parallelogram being found in numbers, they must be multiplied together, and
from

from their product the content of the angular spaces is to be taken, and the remainder will be the content of the survey (by Prop. XIII.)

For a more clear idea of these operations, see the foregoing algebraical explication of this method; together with the following example in numbers.

St.	N.	S.	L. N.	L. S.	L. A.	D. S.	E.	W.	
1	---	5.75		0.00	5.75	+	076.5900	---	13.32
2	30.28	---		30.28	30.28	+	468.7344	---	15.48
3	9.28	---		39.51	69.79	+	687.4315	---	9.85
4	9.04	---	6.17	48.55	88.06	+	626.1066	---	7.11
5	4.66	---	1.51		7.68	+	088.9344	11.58	---
6	1.51	---	0.00		1.51	+	020.2340	13.40	---
7	---	6.78	6.78		6.78	+	049.8330	7.35	---
8	---	17.46	24.24		31.02	+	268.3230	8.65	---
9	---	12.97	37.21		61.45	—	233.5100	---	3.80
10	---	11.76	48.97	5.75	86.18	+	739.4244	8.58	---
54.72		54.72			=2792.1013		49.56	49.56	

1396.0506 = angular Spaces.

Sum E. or W. 49.56
Indirect 3.80

45.76 = Parallel Breadth.
54.72 = Meridional Breadth.

9152
32032
18304
22880

2503.9872 = circumscribing Parallelogram.
1396.0506 = Content of the angular Spaces.

a 110,7.9366 = Content of the Survey = 110 A. 3 R. 6 P.

4
r 3.16
40
p 6.40

In this example it is easily seen that the four extremes N. S. E. W. are the 6th 1st 10th and 4th stations respectively, you may also see that the two latitudes of the extreme W. is equal to the two latitudes of the extreme E. that is $6.17 + 48.55 = 45.97 + 5.75$.

If you should begin with the eastings and westings, and so proceed as you were directed all long with the northings and southings, you can discover the content of the survey two different ways, and so prove the work if there should be an occasion. In Mr. BURGH's, method of calculation, the content of a survey may be found four different ways. He takes the extreme point south, from which he finds the latitude of every station round the whole survey. Then the sum of all the direct semi-rectangles of those stations, lying north of the extremes east and west, abating all the indirect ones therein, will be the content of the area, or figure $DWNECD$, and the sum of all the direct semirectangles of those stations lying south of the extremes E. and W. abating all the indirect ones therein, will be the content of the angular spaces, or areas DWS and CES ; which last sum being taken from the former, will leave the content

tent of the survey $W\ 2\ N\ 5\ E\ S\ W$ (see fig. 6.) By proceeding in this manner from the other three extremes, the content may be discovered four different ways.

Here followeth an algebraical explication of Mr. BURGH's method in finding the content of fig. 6.

St. N.	S. E. W.	L. S.	L. A.	D. S.
1	a	$n+p+q-a$	$2n+2p+2q-a$	$+xX:2n+2p+2q-g:$
2	b	$m+k+b-e+d$	$2n+2p+2q-2a+b$	$+yX:2n+2p+2q-2a+b:$
3	d	$m+k+b+e$	$2m+2k+2b+2e+d$	$+uX:2m+2k+2b+2e+d:$
4	e	$m+k+b$	$2m+2k+2b+e$	$-wX:2m+2k+2b+e:$
5	b	$m+k$	$2m+2k+b$	$+tX:2m+2+kb:$
6	k	m	$2m+k$	$+sX:2m+k:$
7	m	m	m	$-rX:m$
8	n	n	n	$-xX:n$
9	p	$n+p$	$2n+p$	$-fX:2n+p:$
10	q	$n+p+q$	$2n+2p+q$	$+iX:2n+2p+q:$
				$\equiv$ double the Content.

To practice with this method, if you would take the sum of the northings or southings, and put it over the column of latitudes, and then either add or subtract the northings, and subtract or add the southings successively; but when you add one, you must subtract the other, and then you shall have the latitude of each station from a parallel, whose distance from the beginning of the first station, is equal to the northings or southings; and also equal to the latitude that shall come out for the last station, which will be a proof to so much of the work: Then add the two latitudes next adjoining, and so proceed as usual. If you calculate this way, there will be no necessity to find out any extreme point: But then the multiplications will be vastly more troublesome than in the common way, as the latitudes will be always larger numbers; but the foregoing *new method* will be much more easy in this respect, than either.

We shall here calculate the second example in page 89, by this way of Mr. BURGH's method, as it is used in practice; and the eastings and westings, we shall call the northings and southings, &c. that is, we shall begin the calculation from them.

O

This

This way of using Mr. BURGH's method, is the very same of Mr. GIBSON's two first methods, only that he uses the half departures instead of whole departures.

St.	N.	S.	22.90	L. A.	E. Area.	W. Area.	E.	W.
1	8.75	---	14.15	37.05	- - -	180.4335	---	4.87
2	---	0.46	14.61	28.76	- - -	146.1008	---	5.08
3	5.93	---	8.68	23.29	- - -	82.6795	---	3.55
4	---	2.41	11.09	19.77	- - -	129.8889	---	6.57
5	1.31	---	9.78	20.87	- - -	164.8730	---	7.90
6	---	17.57	27.35	37.13	144.8070	- - -	3.90	---
7	0.54	---	26.81	54.16	432.1968	- - -	7.98	---
8	---	2.46	29.27	56.08	22.9928	- - -	0.41	---
9	1.84	---	27.43	56.70	383.2920	- - -	6.76	---
10	4.53	---	22.90	50.33	448.9436	- - -	8.92	---
22.90, 22.90			2 S. = Sum	1432.2322	703.9757	27.97	27.97	

703.9757

2)728.2565 A. R. P.

Content 36,41282=36 1 26

In the practice of Mr. BURGH's method, there are two columns as in the above, one of which contains the semirectangles of all the easting stations, called the *East-Area*, the other all those of the westing stations, called the *West-Area*; and the difference of these two columns will give the content required. If the latitudes be measured from a southern parallel or extreme, then the *East-Area* will be the largest: but if the latitudes be taken from a northern parallel

d, rallel or extreme, then the *West-Area* will be the largest, that is, supposing the land to be surveyed after the common manner, by keeping it on the right hand, as the Surveyor furrounds it.

PROPOSITION XV.

PROB.

To find the Content of the Off-sets and In-sets of any Survey by Calculation.

Let the *sum* of every two off-sets next each other be taken; and the *difference* of every two distances on the station line at which the off-sets were made; and these corresponding sums and differences being multiplied together, will give the double content of the off-sets (per Axiom II.)

Take the following example in calculating the off-sets and in-sets to fig. 5, see the field-notes, page 40. First rule four columns in the manner following; the first for numbring the station, the second for the sums of every two off-sets next adjoining, the third for their intermediate distances on the station line, and the fourth for the products of these sums and differences.

In

St.	S.	D.	Prod.
	.30	4.20	1.2600
	2.20	2.80	6.1600
	1.15	6.00	6.9000
3	.15	1.90	0.2850
	.10	17.60	1.7600
5	.20	1.50	0.3000
	2.40	1.00	2.4000
	2.30	6.30	14.4900
6	0.80	6.70	5.4000
	1.00	3.60	3.6000
7	.90	5.90	5.3100

Off-fets 47.8650

	.30	7.50	2.2500
	.15	1.00	0.1500
1	.20	1.50	0.3000
	.35	2.00	0.7000
	.30	1.00	3.3000
2	.20	7.50	1.5000
3	.10	3.50	0.3500
5	.40	1.50	0.6000
6	.90	4.20	3.7800

In-fets 12.9300

2)34.9350

Rem^s off-fets 1.74675

ate distance 1.90: Thus you may go through the whole off-fets and in-fets, and find their contents as in the annexed columns. You must observe that though the field-notes are taken in two-pole chains, yet the sums and differences in this calculation, is turned into four-pole chains, or links, which may be done in the mind, as they are taking out of the field-book. And when the contents of the off-fets and in-fets are found, add the contents of the off-fets to the body-of-the-land, and subtract the in-fets therefrom, and then you will have the content of the whole survey.

In taking these numbers from the field-book, you may begin with either the off-fets or in-fets, it's no matter which. In this survey the first and second stations hath all in-fets; for the 1st station add .15 and 15 together, the two first insets; their sum .30 links set down in the first column, and their intermediate distance 7.50 set down in the second column; the two next insets, that is, .15 and [0] is .15 links, and their intermediate distance 1.00; then the two next and last insets are 0 and 20, and their intermediate distance is 1.50, and so of the rest. The off-fets begin at 7 two-pole chains on the third station, the sum of the two first, that is [0] and 30, is .30 links, their intermediate distance 4.20; the sum of the two next off-fets is 2.20, and their intermediate distance is 2.80; the sum of the two next is 1.15, and their intermediate distance 6.00; the sum of the two next, which are the

Fig:1

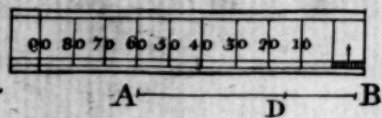


Fig:2

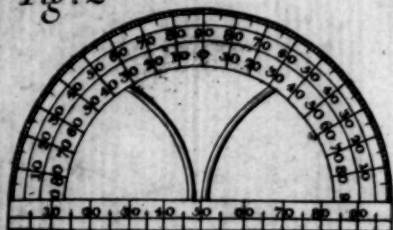


Fig:3

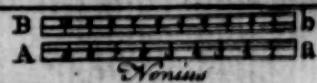
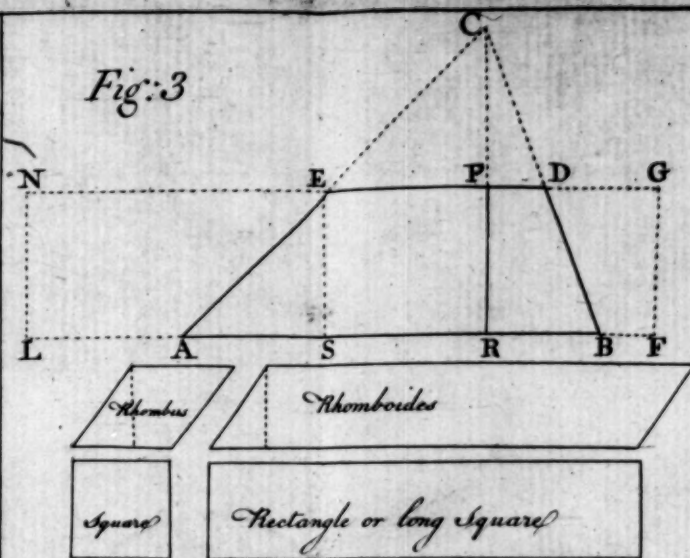


Fig:4

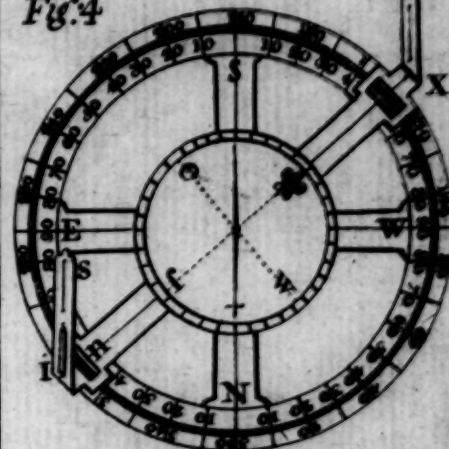


Fig:5

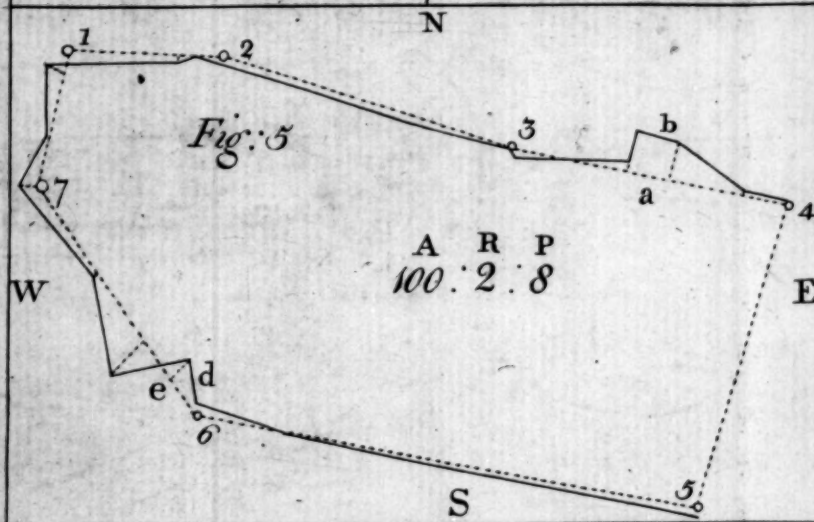


Fig:7

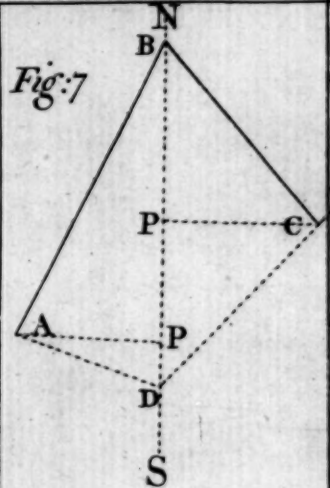


Fig:8

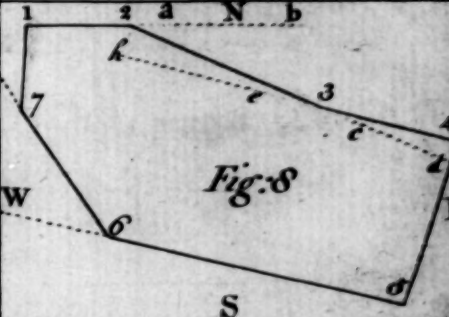


Fig:9

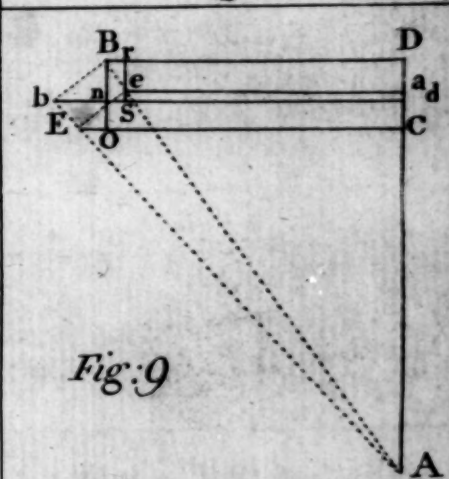


Fig:6

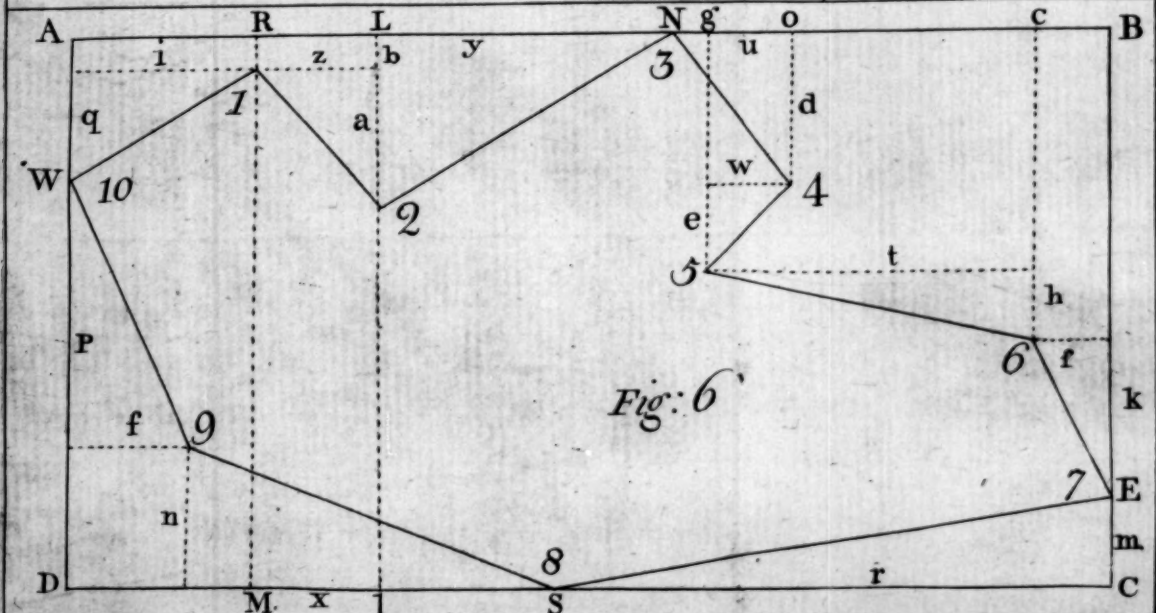
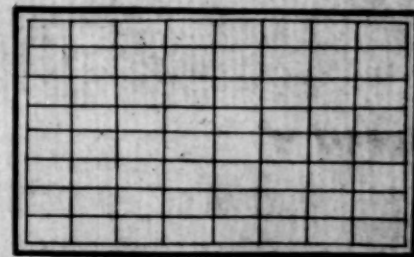


Fig:10



T A B L E S
O F
RIGHT-ANGLED TRIANGLES:

In which may be found,

By Inspection only,

T H E
Difference of Latitude, and Departure,
For any STATION,

That may happen in the PRACTICE of

LAND-SURVEYING.

By B. N.

D U B L I N:

Printed for the AUTHOR, by ALEX. M'CULLOH,
in *Henry-street*, 1767.

TABLE 3

OF

RIGHT-ANGLED TRIANGLES

to which may be applied

By Inspection only

THE

NEW

EDITION

OF

LAND-SURVEYING

BY



N:

D

Printed by W. Clowes, 10, Abchurch Lane, London, E.C. 4.

ap. ch.	0 $\frac{1}{2}$	89 $\frac{1}{2}$	0 $\frac{1}{2}$	89 $\frac{1}{2}$	0 $\frac{1}{2}$	89 $\frac{1}{2}$	45	45
6	3.00	0.01	3.00	0.03	3.00	0.04	2.12	2.12
7	3.50	0.02	3.50	0.03	3.50	0.04	2.47	2.47
8	4.00	0.02	4.00	0.03	4.00	0.05	2.83	2.83
9	4.50	0.02	4.50	0.04	4.50	0.06	3.18	3.18
10	5.00	0.02	5.00	0.04	5.00	0.07	3.54	3.54
11	5.50	0.02	5.50	0.05	5.50	0.07	3.89	3.89
12	6.00	0.03	6.00	0.05	6.00	0.08	4.24	4.24
13	6.50	0.03	6.50	0.06	6.50	0.08	4.60	4.60
14	7.00	0.03	7.00	0.06	7.00	0.09	4.95	4.95
15	7.50	0.03	7.50	0.07	7.50	0.10	5.30	5.30
16	8.00	0.03	8.00	0.07	8.00	0.10	5.66	5.66
17	8.50	0.04	8.50	0.08	8.50	0.11	6.01	6.01
18	9.00	0.04	9.00	0.08	9.00	0.12	6.36	6.36
19	9.50	0.04	9.50	0.08	9.50	0.13	6.72	6.72
20	10.00	0.04	10.00	0.09	10.00	0.13	7.07	7.07
21	10.50	0.05	10.50	0.09	10.50	0.14	7.42	7.42
22	11.00	0.05	11.00	0.10	11.00	0.14	7.78	7.78
23	11.50	0.05	11.50	0.10	11.50	0.15	8.13	8.13
24	12.00	0.05	12.00	0.10	12.00	0.16	8.49	8.49
25	12.50	0.05	12.50	0.11	12.50	0.16	8.84	8.84
26	13.00	0.06	13.00	0.11	13.00	0.17	9.19	9.19
27	13.50	0.06	13.50	0.12	13.50	0.18	9.55	9.55
28	14.00	0.06	14.00	0.12	14.00	0.18	9.90	9.90
29	14.50	0.06	14.50	0.12	14.50	0.19	10.26	10.26
30	15.00	0.07	15.00	0.13	15.00	0.19	10.61	10.61
31	15.50	0.07	15.50	0.13	15.50	0.20	10.96	10.96
32	16.00	0.07	16.00	0.14	16.00	0.21	11.31	11.31
33	16.50	0.07	16.50	0.14	16.50	0.21	11.67	11.67
34	17.00	0.07	17.00	0.15	17.00	0.22	12.02	12.02
35	17.50	0.08	17.50	0.15	17.50	0.23	12.38	12.38
36	18.00	0.08	18.00	0.16	18.00	0.23	12.73	12.73
37	18.50	0.08	18.50	0.16	18.50	0.24	13.08	13.08
38	19.00	0.08	19.00	0.16	19.00	0.25	13.43	13.43
39	19.50	0.08	19.50	0.17	19.50	0.25	13.79	13.79
40	20.00	0.09	20.00	0.17	20.00	0.26	14.14	14.14
41	20.50	0.09	20.50	0.18	20.50	0.27	14.50	14.50
42	21.00	0.09	21.00	0.18	21.00	0.27	14.85	14.85
43	21.50	0.09	21.50	0.19	21.50	0.28	15.20	15.20
44	22.00	0.10	22.00	0.19	22.00	0.29	15.56	15.56
45	22.50	0.10	22.50	0.19	22.50	0.29	15.91	15.91
46	23.00	0.10	23.00	0.20	23.00	0.30	16.26	16.26
47	23.50	0.10	23.50	0.20	23.50	0.31	16.62	16.62
48	24.00	0.10	24.00	0.21	24.00	0.31	16.97	16.97
49	24.50	0.11	24.50	0.21	24.50	0.32	17.32	17.32
50	25.00	0.11	25.00	0.22	25.00	0.33	17.68	17.68

Tables of Right-Angled Triangles, &c.

² P- ch.	I	89	I $\frac{1}{4}$	88 $\frac{3}{4}$	I $\frac{1}{2}$	88 $\frac{1}{2}$	I $\frac{3}{4}$	88 $\frac{1}{4}$
6	3.00	0.05	3.00	0.07	3.00	0.08	3.00	0.09
7	3.50	0.06	3.50	0.08	3.50	0.09	3.50	0.11
8	4.00	0.07	4.00	0.09	4.00	0.10	4.00	0.12
9	4.50	0.08	4.50	0.10	4.50	0.12	4.50	0.14
10	5.00	0.09	5.00	0.11	5.00	0.13	5.00	0.15
11	5.50	0.10	5.50	0.12	5.50	0.14	5.50	0.17
12	6.00	0.10	6.00	0.13	6.00	0.16	6.00	0.18
13	6.50	0.11	6.50	0.14	6.50	0.17	6.50	0.20
14	7.00	0.12	7.00	0.15	7.00	0.18	7.00	0.21
15	7.50	0.13	7.50	0.16	7.50	0.19	7.50	0.23
16	8.00	0.14	8.00	0.17	8.00	0.21	7.99	0.24
17	8.50	0.15	8.50	0.19	8.50	0.22	8.49	0.26
18	9.00	0.16	9.00	0.20	9.00	0.24	8.99	0.27
19	9.50	0.17	9.50	0.21	9.50	0.25	9.49	0.29
20	10.00	0.17	10.00	0.22	10.00	0.26	9.99	0.31
21	10.50	0.18	10.50	0.23	10.49	0.28	10.49	0.32
22	11.00	0.19	11.00	0.24	10.99	0.29	10.99	0.34
23	11.50	0.20	11.50	0.25	11.49	0.30	11.49	0.35
24	12.00	0.21	12.00	0.26	11.99	0.31	11.99	0.37
25	12.50	0.21	12.50	0.27	12.49	0.33	12.49	0.38
26	13.00	0.22	13.00	0.28	12.99	0.34	12.99	0.40
27	13.50	0.23	13.50	0.29	13.49	0.35	13.49	0.41
28	14.00	0.24	14.00	0.30	13.99	0.37	13.99	0.43
29	14.50	0.25	14.50	0.32	14.49	0.38	14.49	0.44
30	15.00	0.26	15.00	0.33	14.99	0.39	15.99	0.46
31	15.50	0.27	15.49	0.34	15.49	0.40	15.49	0.47
32	16.00	0.28	15.99	0.35	15.99	0.42	15.99	0.49
33	16.50	0.29	16.49	0.36	16.49	0.43	16.49	0.50
34	17.00	0.30	16.99	0.37	16.99	0.44	16.99	0.52
35	17.50	0.30	17.49	0.38	17.49	0.46	17.49	0.53
36	18.00	0.31	17.99	0.39	17.99	0.47	17.99	0.55
37	18.50	0.32	18.49	0.40	18.49	0.48	18.49	0.56
38	19.00	0.33	18.99	0.41	18.99	0.50	18.99	0.58
39	19.50	0.34	19.49	0.43	19.49	0.51	19.49	0.59
40	20.00	0.35	19.99	0.44	19.99	0.52	19.99	0.61
41	20.50	0.36	20.49	0.45	20.49	0.53	20.49	0.63
42	21.00	0.37	20.99	0.46	20.99	0.55	20.99	0.64
43	21.50	0.37	21.49	0.47	21.49	0.56	21.49	0.66
44	22.00	0.38	21.99	0.48	21.99	0.57	21.99	0.67
45	22.50	0.39	22.49	0.49	22.49	0.59	22.49	0.69
46	23.00	0.40	22.99	0.50	22.99	0.60	22.99	0.70
47	23.50	0.41	23.49	0.51	23.49	0.61	23.49	0.72
48	24.00	0.42	23.99	0.52	23.99	0.63	23.99	0.73
49	24.50	0.43	24.49	0.54	24.49	0.64	24.49	0.75
50	25.00	0.44	24.99	0.55	24.99	0.65	24.99	0.76

$\frac{2p}{ch.}$	2	88	$2\frac{1}{2}$	$87\frac{1}{2}$	$2\frac{1}{2}$	$87\frac{1}{2}$	$2\frac{1}{2}$	$87\frac{1}{2}$
6	3.00	0.10	3.00	0.12	3.00	0.13	3.00	0.14
7	3.50	0.12	3.50	0.14	3.50	0.15	3.50	0.17
8	4.00	0.14	4.00	0.16	4.00	0.17	3.99	0.19
9	4.50	0.15	4.50	0.18	4.49	0.20	4.49	0.22
10	5.00	0.17	5.00	0.20	4.99	0.22	4.99	0.24
11	5.50	0.19	5.49	0.22	5.49	0.24	5.49	0.26
12	5.99	0.21	5.99	0.23	5.99	0.26	5.99	0.29
13	6.49	0.23	6.49	0.25	6.49	0.28	6.49	0.31
14	6.99	0.24	6.99	0.27	6.99	0.31	6.99	0.34
15	7.49	0.26	7.49	0.29	7.49	0.33	7.49	0.36
16	7.99	0.28	7.99	0.31	7.99	0.35	7.99	0.38
17	8.49	0.30	8.49	0.33	8.49	0.37	8.49	0.41
18	8.99	0.31	8.99	0.35	8.99	0.39	8.99	0.43
19	9.49	0.33	9.49	0.37	9.49	0.41	9.49	0.46
20	9.99	0.35	9.99	0.39	9.99	0.44	9.99	0.48
21	10.49	0.37	10.49	0.41	10.49	0.46	10.49	0.50
22	10.99	0.38	10.99	0.43	10.99	0.48	10.99	0.53
23	11.49	0.40	11.49	0.45	11.49	0.50	11.49	0.55
24	11.99	0.42	11.99	0.47	11.99	0.52	11.99	0.57
25	12.49	0.43	12.49	0.49	12.49	0.54	12.49	0.60
26	12.99	0.45	12.99	0.51	12.99	0.56	12.98	0.62
27	13.49	0.47	13.49	0.53	13.49	0.59	13.48	0.65
28	13.99	0.49	13.99	0.55	13.99	0.61	13.98	0.67
29	14.49	0.50	14.49	0.57	14.49	0.63	14.48	0.70
30	14.99	0.52	14.99	0.59	14.98	0.65	14.98	0.72
31	15.49	0.54	15.49	0.61	15.48	0.67	15.48	0.74
32	15.99	0.56	15.99	0.63	15.98	0.70	15.98	0.77
33	16.49	0.57	16.49	0.65	16.48	0.72	16.48	0.79
34	16.99	0.59	16.99	0.67	16.98	0.74	16.98	0.81
35	17.49	0.61	17.49	0.69	17.48	0.76	17.48	0.84
36	17.99	0.63	17.99	0.71	17.98	0.78	17.98	0.86
37	18.49	0.65	18.49	0.73	18.48	0.81	18.48	0.89
38	18.99	0.66	18.99	0.75	18.98	0.83	18.98	0.91
39	19.49	0.68	19.48	0.77	19.48	0.85	19.48	0.93
40	19.99	0.70	19.98	0.79	19.98	0.87	19.98	0.96
41	20.49	0.71	20.48	0.80	20.48	0.89	20.48	0.98
42	20.99	0.73	20.98	0.82	20.98	0.92	20.97	1.01
43	21.49	0.75	21.48	0.84	21.48	0.94	21.47	1.03
44	21.98	0.77	21.98	0.86	21.98	0.96	21.97	1.05
45	22.48	0.78	22.48	0.88	22.48	0.98	22.47	1.08
46	22.98	0.80	22.98	0.90	22.98	1.00	22.97	1.10
47	23.48	0.82	23.48	0.92	23.48	1.03	23.47	1.13
48	23.98	0.84	23.98	0.94	23.98	1.05	23.97	1.15
49	24.48	0.85	24.48	0.96	24.48	1.07	24.47	1.18
50	24.98	0.87	24.98	0.98	24.98	1.09	24.97	1.20

² P. ch.	3	87	3 $\frac{1}{4}$	86 $\frac{3}{4}$	3 $\frac{1}{2}$	86 $\frac{1}{2}$	3 $\frac{3}{4}$	86 $\frac{1}{4}$
6	3.00	0.15	2.99	0.17	2.99	0.18	2.99	0.20
7	3.49	0.18	3.49	0.20	3.49	0.21	3.49	0.23
8	3.99	0.21	3.99	0.23	3.99	0.25	3.99	0.26
9	4.49	0.23	4.49	0.26	4.49	0.28	4.49	0.29
10	4.99	0.26	4.99	0.28	4.99	0.30	4.99	0.33
11	5.49	0.29	5.49	0.31	5.49	0.33	5.49	0.36
12	5.99	0.31	5.99	0.34	5.99	0.37	5.99	0.39
13	6.49	0.34	6.49	0.37	6.49	0.40	6.49	0.42
14	6.99	0.37	6.99	0.39	6.99	0.43	6.98	0.46
15	7.49	0.39	7.49	0.42	7.49	0.46	7.48	0.49
16	7.99	0.42	7.99	0.45	7.98	0.49	7.98	0.52
17	8.49	0.44	8.49	0.48	8.48	0.52	8.48	0.56
18	8.99	0.47	8.98	0.51	8.98	0.55	8.98	0.59
19	9.49	0.50	9.48	0.54	9.48	0.58	9.48	0.62
20	9.99	0.52	9.98	0.57	9.98	0.61	9.98	0.65
21	10.49	0.55	10.48	0.60	10.48	0.64	10.48	0.69
22	10.98	0.58	10.98	0.62	10.98	0.67	10.98	0.72
23	11.48	0.60	11.48	0.65	11.48	0.70	11.47	0.75
24	11.98	0.63	11.98	0.68	11.98	0.73	11.97	0.78
25	12.48	0.65	12.48	0.71	12.48	0.76	12.47	0.82
26	12.98	0.68	12.98	0.74	12.98	0.79	12.97	0.85
27	13.48	0.71	13.48	0.76	13.48	0.82	13.47	0.88
28	13.98	0.73	13.98	0.79	13.97	0.85	13.97	0.91
29	14.48	0.76	14.48	0.82	14.47	0.88	14.47	0.94
30	14.98	0.78	14.98	0.85	14.97	0.92	14.97	0.98
31	15.48	0.81	15.47	0.88	15.47	0.95	15.46	1.01
32	15.98	0.84	15.97	0.91	15.97	0.98	15.96	1.05
33	16.48	0.86	16.47	0.94	16.47	1.01	16.46	1.08
34	16.98	0.89	16.97	0.96	16.97	1.04	16.96	1.11
35	17.48	0.91	17.47	0.99	17.47	1.07	17.46	1.15
36	17.97	0.94	17.97	1.02	17.97	1.10	17.96	1.18
37	18.47	0.97	18.47	1.05	18.46	1.13	18.46	1.21
38	18.97	0.99	18.97	1.08	18.96	1.16	18.96	1.24
39	19.47	1.02	19.47	1.10	19.46	1.19	19.46	1.28
40	19.97	1.05	19.97	1.13	19.96	1.22	19.96	1.31
41	20.47	1.07	20.47	1.16	20.46	1.25	20.46	1.34
42	20.97	1.10	20.97	1.19	20.96	1.28	20.95	1.37
43	21.47	1.12	21.47	1.22	21.46	1.31	21.45	1.41
44	21.97	1.15	21.96	1.25	21.96	1.34	21.95	1.44
45	22.47	1.18	22.46	1.27	22.46	1.37	22.45	1.48
46	22.97	1.21	22.96	1.30	22.96	1.40	22.95	1.51
47	23.47	1.23	23.46	1.33	23.46	1.43	23.45	1.54
48	23.97	1.26	23.96	1.36	23.95	1.46	23.95	1.57
49	24.47	1.28	24.46	1.39	24.45	1.49	24.45	1.60
50	24.96	1.31	24.96	1.42	24.95	1.52	24.95	1.63

Tables of Right-Angled Triangles, &c.

7

² P. ch.	4	86	4 $\frac{1}{2}$	85 $\frac{3}{4}$	4 $\frac{1}{2}$	85 $\frac{1}{2}$	4 $\frac{3}{4}$	85 $\frac{1}{4}$
6	2.99	0.21	2.99	0.22	2.99	0.24	2.99	0.25
7	3.49	0.24	3.49	0.26	3.49	0.27	3.49	0.29
8	3.99	0.28	3.99	0.30	3.99	0.31	3.99	0.33
9	4.49	0.31	4.49	0.33	4.49	0.35	4.48	0.37
10	4.99	0.35	4.99	0.37	4.98	0.39	4.98	0.41
11	5.49	0.38	5.48	0.41	5.48	0.43	5.48	0.46
12	5.98	0.42	5.98	0.44	5.98	0.47	5.98	0.50
13	6.48	0.45	6.48	0.48	6.48	0.51	6.48	0.54
14	6.98	0.49	6.98	0.52	6.98	0.55	6.98	0.58
15	7.48	0.52	7.48	0.55	7.48	0.59	7.47	0.62
16	7.98	0.56	7.98	0.59	7.97	0.63	7.97	0.66
17	8.48	0.59	8.48	0.63	8.47	0.67	8.47	0.70
18	8.98	0.63	8.97	0.67	8.97	0.71	8.97	0.74
19	9.48	0.66	9.47	0.70	9.47	0.75	9.47	0.78
20	9.97	0.70	9.97	0.74	9.97	0.78	9.97	0.83
21	10.47	0.73	10.47	0.78	10.47	0.82	10.46	0.87
22	10.97	0.77	10.97	0.81	10.97	0.86	10.96	0.91
23	11.47	0.80	11.47	0.85	11.46	0.90	11.46	0.95
24	11.97	0.84	11.97	0.89	11.96	0.94	11.96	0.99
25	12.47	0.87	12.46	0.93	12.46	0.98	12.46	1.03
26	12.97	0.91	12.96	0.96	12.96	1.02	12.96	1.08
27	13.47	0.94	13.46	1.00	13.46	1.06	13.45	1.12
28	13.96	0.98	13.96	1.04	13.96	1.10	13.95	1.16
29	14.46	1.01	14.46	1.07	14.45	1.14	14.45	1.20
30	14.96	1.04	14.96	1.11	14.95	1.18	14.95	1.24
31	15.46	1.08	15.46	1.15	15.45	1.22	15.45	1.28
32	15.96	1.12	15.96	1.19	15.95	1.26	15.95	1.32
33	16.46	1.15	16.45	1.22	16.45	1.29	16.44	1.37
34	16.96	1.18	16.95	1.26	16.95	1.33	16.94	1.41
35	17.46	1.22	17.45	1.30	17.45	1.37	17.44	1.45
36	17.96	1.26	17.95	1.33	17.95	1.41	17.94	1.49
37	18.45	1.29	18.45	1.37	18.44	1.45	18.44	1.53
38	18.95	1.33	18.95	1.41	18.94	1.49	18.93	1.57
39	19.45	1.36	19.45	1.44	19.44	1.53	19.43	1.61
40	19.95	1.40	19.94	1.48	19.94	1.57	19.93	1.66
41	20.45	1.43	20.44	1.52	20.44	1.61	20.43	1.70
42	20.95	1.46	20.94	1.56	20.93	1.65	20.93	1.74
43	21.45	1.50	21.44	1.59	21.43	1.69	21.43	1.78
44	21.95	1.53	21.94	1.63	21.93	1.73	21.92	1.82
45	22.44	1.57	22.44	1.67	22.43	1.76	22.42	1.86
46	22.94	1.60	22.94	1.70	22.93	1.80	22.92	1.90
47	23.44	1.64	23.44	1.74	23.43	1.84	23.42	1.94
48	23.94	1.67	23.93	1.78	23.93	1.88	23.92	1.99
49	24.44	1.71	24.43	1.82	24.42	1.92	24.41	2.03
50	24.94	1.74	24.93	1.85	24.92	1.96	24.91	2.07

^{2p.} ch.	5	85	5 $\frac{1}{2}$	84 $\frac{1}{2}$	5 $\frac{1}{2}$	84 $\frac{1}{2}$	5 $\frac{1}{2}$	84 $\frac{1}{2}$
6	2.99	0.26	2.99	0.27	2.99	0.29	2.98	0.30
7	3.49	0.30	3.48	0.32	3.48	0.33	3.48	0.35
8	3.98	0.35	3.98	0.37	3.98	0.38	3.98	0.40
9	4.48	0.39	4.48	0.41	4.48	0.43	4.48	0.45
10	4.98	0.44	4.98	0.46	4.98	0.48	4.97	0.50
11	5.48	0.48	5.48	0.50	5.98	0.53	5.47	0.55
12	5.98	0.52	5.97	0.55	5.97	0.58	5.97	0.60
13	6.47	0.57	6.47	0.60	6.47	0.62	6.47	0.65
14	6.97	0.61	6.97	0.64	6.97	0.67	6.96	0.70
15	7.47	0.65	7.47	0.69	7.47	0.72	7.46	0.75
16	7.97	0.70	7.97	0.73	7.96	0.77	7.96	0.80
17	8.47	0.74	8.46	0.78	8.46	0.81	8.46	0.85
18	8.97	0.78	8.96	0.82	8.96	0.86	8.95	0.90
19	9.46	0.83	9.46	0.87	9.46	0.91	9.45	0.95
20	9.96	0.87	9.96	0.91	9.95	0.96	9.95	1.00
21	10.46	0.91	10.46	0.96	10.45	1.01	10.45	1.05
22	10.96	0.96	10.95	1.01	10.95	1.05	10.94	1.10
23	11.45	1.00	11.45	1.06	11.45	1.10	11.44	1.15
24	11.95	1.05	11.95	1.10	11.94	1.15	11.94	1.20
25	12.45	1.09	12.45	1.15	12.44	1.20	12.44	1.25
26	12.95	1.13	12.95	1.19	12.94	1.25	12.93	1.30
27	13.45	1.17	13.44	1.24	13.44	1.29	13.43	1.35
28	13.95	1.22	13.94	1.29	13.93	1.34	13.93	1.40
29	14.45	1.26	14.44	1.33	14.43	1.39	14.42	1.45
30	14.95	1.31	14.94	1.37	14.93	1.44	14.92	1.50
31	15.44	1.35	15.44	1.42	15.43	1.49	15.42	1.55
32	15.94	1.39	15.93	1.47	15.93	1.53	15.92	1.60
33	16.44	1.44	16.43	1.51	16.42	1.58	16.42	1.65
34	16.93	1.48	16.93	1.56	16.92	1.63	16.92	1.70
35	17.43	1.52	17.43	1.61	17.42	1.68	17.41	1.75
36	17.93	1.57	17.92	1.65	17.92	1.72	17.91	1.80
37	18.43	1.61	18.42	1.69	18.41	1.77	18.41	1.85
38	18.93	1.65	18.92	1.74	18.91	1.82	18.90	1.90
39	19.42	1.70	19.42	1.79	19.41	1.87	19.40	1.95
40	19.92	1.74	19.92	1.83	19.91	1.92	19.90	2.00
41	20.42	1.78	20.41	1.88	20.40	1.97	20.40	2.05
42	20.92	1.83	20.91	1.92	20.90	2.01	20.89	2.10
43	21.42	1.87	21.41	1.97	21.40	2.06	21.39	2.15
44	21.91	1.92	21.91	2.01	21.90	2.11	21.89	2.20
45	22.41	1.96	22.41	2.06	22.40	2.16	22.38	2.25
46	22.91	2.00	22.90	2.11	22.89	2.20	22.88	2.30
47	23.41	2.05	23.40	2.15	22.39	2.25	23.38	2.35
48	23.91	2.09	23.90	2.20	23.89	2.30	23.88	2.40
49	24.40	2.14	24.39	2.24	24.39	2.35	24.38	2.45
50	24.90	2.18	24.89	2.29	24.88	2.40	24.87	2.50

² p. ch.	6	84	6 $\frac{1}{4}$	83 $\frac{3}{4}$	6 $\frac{1}{2}$	83 $\frac{1}{2}$	6 $\frac{3}{4}$	83 $\frac{1}{4}$
6	2.98	0.31	2.98	0.33	2.98	0.34	2.98	0.35
7	3.48	0.36	3.48	0.38	3.48	0.40	3.48	0.41
8	3.98	0.42	3.98	0.43	3.97	0.45	3.97	0.47
9	4.48	0.47	4.47	0.49	4.47	0.51	4.47	0.53
10	4.97	0.52	4.97	0.54	4.97	0.57	4.96	0.59
11	5.47	0.57	5.47	0.59	5.46	0.62	5.46	0.65
12	5.97	0.63	5.96	0.65	5.96	0.68	5.96	0.70
13	6.46	0.68	6.46	0.70	6.46	0.74	6.45	0.76
14	6.96	0.73	6.96	0.76	6.96	0.79	6.95	0.82
15	7.46	0.78	7.46	0.81	7.45	0.85	7.45	0.88
16	7.96	0.84	7.95	0.87	7.95	0.90	7.94	0.94
17	8.45	0.89	8.45	0.92	8.44	0.96	8.44	1.00
18	8.95	0.94	8.95	0.98	8.94	1.02	8.94	1.06
19	9.45	0.99	9.44	1.03	9.44	1.07	9.43	1.12
20	9.94	1.05	9.94	1.09	9.94	1.13	9.93	1.18
21	10.44	1.10	10.44	1.14	10.43	1.19	10.43	1.23
22	10.94	1.15	10.93	1.20	10.93	1.25	10.92	1.29
23	11.44	1.20	11.43	1.25	11.42	1.30	11.42	1.35
24	11.93	1.25	11.93	1.31	11.92	1.36	11.92	1.41
25	12.43	1.30	12.43	1.36	12.42	1.41	12.41	1.47
26	12.93	1.36	12.92	1.41	12.91	1.47	12.91	1.53
27	13.42	1.41	13.42	1.47	13.41	1.53	13.40	1.59
28	13.92	1.46	13.92	1.52	13.91	1.58	13.90	1.65
29	14.42	1.51	14.41	1.57	14.41	1.64	14.40	1.70
30	14.92	1.57	14.91	1.63	14.90	1.70	14.90	1.76
31	15.41	1.62	15.41	1.68	15.40	1.76	15.39	1.82
32	15.91	1.67	15.90	1.74	15.90	1.81	15.89	1.88
33	16.41	1.72	16.40	1.80	16.39	1.87	16.38	1.94
34	16.90	1.78	16.90	1.85	16.89	1.92	16.88	2.00
35	17.40	1.83	17.40	1.90	17.39	1.98	17.38	2.06
36	17.90	1.88	17.89	1.96	17.88	2.04	17.87	2.12
37	18.40	1.93	18.39	2.01	18.38	2.10	18.37	2.17
38	18.90	1.98	18.89	2.07	18.88	2.15	18.87	2.23
39	19.39	2.01	19.38	2.12	19.37	2.21	19.36	2.29
40	19.89	2.09	19.88	2.18	19.87	2.26	19.86	2.35
41	20.39	2.14	20.38	2.23	20.37	2.32	20.36	2.41
42	20.88	2.19	20.87	2.29	20.86	2.38	20.85	2.47
43	21.38	2.25	21.37	2.34	21.36	2.43	21.35	2.53
44	21.88	2.30	21.87	2.39	21.86	2.49	21.85	2.59
45	22.37	2.35	22.37	2.44	22.35	2.55	22.34	2.65
46	22.87	2.40	22.86	2.50	22.85	2.60	22.84	2.70
47	23.37	2.45	23.36	2.55	23.35	2.66	23.33	2.76
48	23.87	2.51	23.86	2.61	23.85	2.72	23.83	2.82
49	24.37	2.56	24.35	2.67	24.34	2.77	24.33	2.88
50	24.86	2.61	24.85	2.72	24.84	2.83	24.83	2.94

² P. ch.	7	83	7 $\frac{1}{4}$	82 $\frac{1}{4}$	7 $\frac{1}{2}$	82 $\frac{1}{2}$	7 $\frac{3}{4}$	82 $\frac{3}{4}$
6	2.98	0.36	2.98	0.37	2.97	0.39	2.97	0.41
7	3.47	0.43	3.47	0.44	3.47	0.46	3.47	0.47
8	3.97	0.49	3.97	0.50	3.97	0.52	3.96	0.54
9	4.47	0.55	4.46	0.57	4.46	0.59	4.46	0.61
10	4.96	0.61	4.96	0.63	4.96	0.65	4.95	0.68
11	5.46	0.67	5.46	0.70	5.45	0.72	5.45	0.74
12	5.96	0.73	5.95	0.76	5.95	0.78	5.95	0.81
13	6.45	0.79	6.45	0.82	6.44	0.85	6.44	0.87
14	6.95	0.85	6.94	0.88	6.94	0.91	6.94	0.94
15	7.44	0.91	7.44	0.95	7.44	0.98	7.43	1.01
16	7.94	0.97	7.94	1.01	7.93	1.01	7.93	1.08
17	8.43	1.04	8.43	1.07	8.43	1.11	8.42	1.14
18	8.93	1.10	8.93	1.13	8.92	1.18	8.92	1.21
19	9.43	1.16	9.42	1.20	9.42	1.24	9.41	1.28
20	9.92	1.22	9.92	1.26	9.91	1.31	9.91	1.35
21	10.42	1.28	10.42	1.32	10.41	1.37	10.40	1.41
22	10.92	1.34	10.91	1.39	10.91	1.44	10.90	1.48
23	11.41	1.40	11.41	1.45	11.40	1.50	11.39	1.55
24	11.91	1.46	11.90	1.51	11.90	1.57	11.89	1.62
25	12.41	1.52	12.40	1.57	12.39	1.63	12.39	1.69
26	12.90	1.58	12.89	1.64	12.89	1.70	12.88	1.75
27	13.40	1.65	13.39	1.70	13.38	1.76	13.38	1.82
28	13.89	1.71	13.89	1.76	13.88	1.83	13.87	1.89
29	14.39	1.77	14.38	1.83	14.37	1.89	14.37	1.95
30	14.89	1.83	14.88	1.89	14.87	1.96	14.86	2.02
31	15.38	1.89	15.38	1.95	15.37	2.02	15.35	2.09
32	15.88	1.95	15.87	2.02	15.86	2.09	15.85	2.16
33	16.38	2.01	16.37	2.08	16.36	2.15	16.35	2.23
34	16.87	2.07	16.87	2.14	16.85	2.22	16.84	2.29
35	17.37	2.13	17.36	2.21	17.35	2.28	17.34	2.36
36	17.87	2.19	17.86	2.27	17.85	2.34	17.84	2.43
37	18.36	2.25	18.35	2.33	18.34	2.41	18.33	2.50
38	18.86	2.32	18.85	2.40	18.84	2.47	18.83	2.56
39	19.35	2.38	19.34	2.46	19.33	2.54	19.32	2.63
40	19.85	2.44	19.84	2.52	19.83	2.61	19.82	2.69
41	20.35	2.50	20.34	2.59	20.32	2.67	20.31	2.76
42	20.84	2.56	20.83	2.65	20.82	2.74	20.81	2.83
43	21.34	2.62	21.33	2.71	21.32	2.81	21.30	2.90
44	21.83	2.68	21.83	2.78	21.81	2.87	21.80	2.97
45	22.33	2.74	22.32	2.84	22.31	2.94	22.29	3.04
46	22.83	2.80	22.82	2.90	22.80	3.00	22.79	3.11
47	23.32	2.87	23.31	2.97	23.30	3.07	23.28	3.18
48	23.82	2.93	23.81	3.03	23.79	3.13	23.78	3.24
49	24.32	2.99	24.30	3.09	24.29	3.19	24.27	3.31
50	24.81	3.05	24.80	3.15	24.79	3.26	24.77	3.37

Tables of Right-Angled Triangles, &c.

11

2P. ch.	8	82	8 $\frac{1}{2}$	8I $\frac{1}{2}$	8 $\frac{1}{2}$	8I $\frac{1}{2}$	8 $\frac{1}{2}$	8I $\frac{1}{2}$
6	2.97	0.42	2.97	0.43	2.97	0.44	2.96	0.46
7	3.47	0.49	3.46	0.50	3.46	0.52	3.46	0.53
8	3.96	0.56	3.96	0.57	3.96	0.59	3.95	0.61
9	4.46	0.63	4.45	0.65	4.45	0.67	4.45	0.68
10	4.95	0.70	4.95	0.72	4.95	0.74	4.94	0.76
11	5.45	0.77	5.44	0.79	5.44	0.81	5.44	0.84
12	5.94	0.84	5.94	0.86	5.93	0.89	5.93	0.91
13	6.44	0.90	6.43	0.93	6.43	0.96	6.42	0.99
14	6.93	0.97	6.93	1.00	6.92	1.03	6.92	1.06
15	7.43	1.04	7.42	1.07	7.42	1.11	7.41	1.14
16	7.92	1.11	7.92	1.15	7.91	1.18	7.91	1.22
17	8.42	1.18	8.41	1.22	8.41	1.26	8.40	1.29
18	8.91	1.25	8.91	1.29	8.90	1.33	8.90	1.37
19	9.41	1.32	9.40	1.36	9.40	1.40	9.39	1.44
20	9.90	1.39	9.90	1.43	9.89	1.48	9.88	1.52
21	10.40	1.46	10.39	1.51	10.38	1.55	10.38	1.60
22	10.89	1.53	10.89	1.58	10.88	1.63	10.87	1.67
23	11.39	1.60	11.38	1.65	11.37	1.70	11.36	1.75
24	11.88	1.67	11.88	1.72	11.87	1.77	11.86	1.83
25	12.38	1.74	12.37	1.79	12.36	1.85	12.35	1.90
26	12.87	1.81	12.87	1.87	12.86	1.92	12.85	1.98
27	13.37	1.88	13.36	1.94	13.35	2.00	13.34	2.05
28	13.86	1.95	13.85	2.01	13.85	2.07	13.84	2.13
29	14.36	2.02	14.35	2.08	14.34	2.14	14.33	2.20
30	14.85	2.09	14.84	2.15	14.83	2.22	14.83	2.28
31	15.35	2.16	15.34	2.22	15.33	2.29	15.32	2.36
32	15.84	2.23	15.83	2.30	15.82	2.36	15.81	2.43
33	16.34	2.30	16.33	2.37	16.32	2.44	16.31	2.51
34	16.83	2.37	16.82	2.44	16.81	2.51	16.80	2.59
35	17.33	2.44	17.32	2.51	17.31	2.59	17.29	2.66
36	17.82	2.51	17.81	2.58	17.80	2.66	17.79	2.74
37	18.32	2.57	18.31	2.65	18.30	2.73	18.28	2.81
38	18.81	2.64	18.80	2.73	18.79	2.81	18.78	2.89
39	19.31	2.71	19.30	2.80	19.29	2.88	19.27	2.97
40	19.81	2.78	19.79	2.87	19.78	2.96	19.77	3.04
41	20.30	2.85	20.29	2.94	20.27	3.03	20.26	3.12
42	20.80	2.92	20.78	3.01	20.77	3.10	20.76	3.19
43	21.29	2.99	21.28	3.08	21.26	3.18	21.25	3.27
44	21.79	3.06	21.77	3.16	21.76	3.25	21.74	3.35
45	22.28	3.13	22.27	3.23	22.25	3.33	22.24	3.42
46	22.78	3.20	22.76	3.30	22.75	3.40	22.73	3.50
47	23.27	3.27	23.26	3.37	23.24	3.47	23.23	3.57
48	23.77	3.34	23.75	3.44	23.74	3.55	23.72	3.65
49	24.26	3.41	24.25	3.52	24.23	3.62	24.21	3.73
50	24.76	3.48	24.74	3.59	24.73	3.69	24.71	3.80

² p. ch.	9	81	9 $\frac{1}{4}$	80 $\frac{3}{4}$	9 $\frac{1}{2}$	80 $\frac{1}{2}$	9 $\frac{3}{4}$	80 $\frac{1}{4}$
6	2.96	0.47	2.96	0.48	2.96	0.49	2.96	0.51
7	3.46	0.55	3.45	0.56	3.45	0.58	3.45	0.59
8	3.95	0.63	3.95	0.64	3.95	0.66	3.94	0.68
9	4.44	0.70	4.44	0.72	4.44	0.74	4.44	0.76
10	4.94	0.78	4.94	0.80	4.93	0.83	4.93	0.85
11	5.43	0.86	5.43	0.88	5.42	0.91	5.42	0.93
12	5.93	0.94	5.92	0.96	5.92	0.99	5.91	1.02
13	6.42	1.02	6.42	1.04	6.41	1.07	6.41	1.10
14	6.91	1.10	6.91	1.12	6.90	1.16	6.90	1.19
15	7.41	1.17	7.40	1.20	7.40	1.24	7.39	1.27
16	7.90	1.25	7.90	1.28	7.89	1.32	7.88	1.35
17	8.39	1.33	8.39	1.36	8.38	1.40	8.38	1.44
18	8.89	1.41	8.88	1.45	8.88	1.48	8.87	1.52
19	9.38	1.49	9.38	1.53	9.37	1.57	9.36	1.61
20	9.88	1.56	9.87	1.61	9.86	1.65	9.86	1.69
21	10.37	1.64	10.37	1.69	10.36	1.73	10.35	1.78
22	10.87	1.72	10.87	1.77	10.85	1.82	10.84	1.86
23	11.36	1.80	11.36	1.85	11.34	1.90	11.33	1.95
24	11.85	1.88	11.84	1.93	11.84	1.98	11.83	2.03
25	12.35	1.95	12.34	2.01	12.33	2.06	12.32	2.12
26	12.84	2.03	12.83	2.09	12.82	2.15	12.81	2.20
27	13.33	2.11	13.33	2.17	13.31	2.23	13.30	2.29
28	13.83	2.19	13.82	2.25	13.81	2.31	13.80	2.37
29	14.32	2.27	14.31	2.33	14.30	2.39	14.29	2.46
30	14.81	2.35	14.80	2.41	14.79	2.48	14.78	2.54
31	15.31	2.42	15.30	2.49	15.29	2.56	15.28	2.62
32	15.80	2.50	15.79	2.57	15.78	2.64	15.77	2.71
33	16.30	2.58	16.29	2.65	16.27	2.72	16.26	2.79
34	16.79	2.66	16.78	2.73	16.77	2.81	16.76	2.88
35	17.29	2.74	17.28	2.81	17.26	2.89	17.25	2.96
36	17.78	2.84	17.77	2.89	17.75	2.97	17.74	3.05
37	18.27	2.89	18.26	2.97	18.25	3.05	18.23	3.13
38	18.76	2.97	18.75	3.05	18.74	3.14	18.72	3.22
39	19.26	3.05	19.25	3.13	19.23	3.22	19.22	3.30
40	19.75	3.13	19.74	3.22	19.73	3.30	19.71	3.39
41	20.25	3.21	20.23	3.30	20.22	3.39	20.20	3.47
42	20.74	3.29	20.73	3.38	20.71	3.47	20.70	3.55
43	21.24	3.36	21.22	3.45	21.21	3.55	21.19	3.64
44	21.73	3.44	21.72	3.53	21.70	3.63	21.68	3.73
45	22.22	3.52	22.21	3.61	22.19	3.72	22.18	3.81
46	22.72	3.60	22.70	3.69	22.68	3.80	22.67	3.90
47	23.21	3.68	23.20	3.78	23.18	3.88	23.16	3.98
48	23.70	3.75	23.69	3.86	23.67	3.96	23.65	4.06
49	24.20	3.83	24.18	3.94	24.16	4.05	24.14	4.15
50	24.69	3.91	24.67	4.02	24.66	4.13	24.64	4.23

² p. ch.	10	80	10 ⁺	79 ⁺	10 ⁺	79 ⁺	10 ⁺	79 ⁺
6	2.95	0.52	2.95	0.53	2.95	0.55	2.95	0.56
7	3.45	0.61	3.44	0.62	3.44	0.64	3.44	0.65
8	3.94	0.69	3.94	0.71	3.93	0.73	3.93	0.75
9	4.43	0.78	4.43	0.80	4.42	0.82	4.42	0.84
10	4.92	0.87	4.92	0.89	4.92	0.91	4.91	0.93
11	5.42	0.96	5.41	0.98	5.41	1.00	5.40	1.02
12	5.91	1.04	5.90	1.07	5.90	1.09	5.89	1.12
13	6.40	1.13	6.40	1.16	6.39	1.18	6.38	1.21
14	6.89	1.22	6.89	1.25	6.88	1.28	6.88	1.30
15	7.39	1.31	7.38	1.34	7.37	1.37	7.37	1.40
16	7.88	1.39	7.87	1.42	7.87	1.46	7.86	1.49
17	8.37	1.48	8.36	1.51	8.36	1.55	8.35	1.59
18	8.86	1.56	8.86	1.60	8.85	1.64	8.84	1.68
19	9.36	1.65	9.35	1.69	9.34	1.73	9.33	1.77
20	9.85	1.74	9.84	1.78	9.83	1.82	9.82	1.87
21	10.34	1.82	10.33	1.87	10.32	1.91	10.31	1.96
22	10.83	1.91	10.82	1.96	10.81	2.00	10.81	2.05
23	11.32	2.00	11.32	2.05	11.31	2.09	11.30	2.14
24	11.82	2.08	11.81	2.13	11.80	2.19	11.79	2.24
25	12.31	2.17	12.30	2.22	12.29	2.28	12.28	2.33
26	12.80	2.26	12.79	2.31	12.78	2.37	12.77	2.42
27	13.29	2.34	13.28	2.40	13.27	2.46	13.26	2.52
28	13.79	2.43	13.78	2.49	13.77	2.55	13.75	2.61
29	14.28	2.52	14.27	2.58	14.26	2.64	14.24	2.70
30	14.77	2.60	14.76	2.67	14.75	2.73	14.74	2.80
31	15.26	2.69	15.25	2.76	15.24	2.82	15.23	2.89
32	15.76	2.78	15.74	2.85	15.73	2.91	15.72	2.98
33	16.25	2.86	16.24	2.94	16.22	3.00	16.21	3.08
34	16.74	2.95	16.73	3.02	16.72	3.09	16.70	3.17
35	17.23	3.04	17.22	3.11	17.21	3.19	17.19	3.26
36	17.73	3.13	17.71	3.20	17.70	3.28	17.68	3.36
37	18.22	3.21	18.20	3.29	18.19	3.37	18.17	3.45
38	18.71	3.30	18.70	3.38	18.68	3.46	18.66	3.54
39	19.20	3.39	19.19	3.47	19.17	3.55	19.15	3.64
40	19.70	3.47	19.68	3.56	19.66	3.65	19.65	3.73
41	20.19	3.56	20.17	3.65	20.16	3.74	20.14	3.82
42	20.68	3.65	20.66	3.74	20.66	3.83	20.63	3.92
43	21.17	3.73	21.15	3.83	21.14	3.92	21.12	4.01
44	21.66	3.82	21.65	3.91	21.63	4.01	21.61	4.10
45	22.16	3.90	22.14	4.00	22.12	4.10	22.10	4.20
46	22.65	3.99	22.63	4.09	22.61	4.19	22.59	4.29
47	23.14	4.08	23.12	4.18	23.11	4.28	23.09	4.38
48	23.63	4.17	23.62	4.27	23.60	4.37	23.58	4.48
49	24.13	4.25	24.11	4.36	24.09	4.46	24.07	4.56
50	24.62	4.34	24.60	4.45	24.58	4.56	24.56	4.66

14 Tables of Right-Angled Triangles, &c.

² p. ch.	II	79	II $\frac{1}{4}$	78 $\frac{1}{4}$	II $\frac{1}{2}$	78 $\frac{1}{2}$	II $\frac{3}{4}$	78 $\frac{3}{4}$
6	2.94	0.57	2.94	0.59	2.94	0.60	2.94	0.61
7	3.44	0.67	3.43	0.68	3.43	0.70	3.43	0.71
8	3.93	0.76	3.92	0.78	3.92	0.80	3.92	0.81
9	4.42	0.86	4.41	0.88	4.41	0.90	4.41	0.92
10	4.91	0.95	4.90	0.98	4.90	1.00	4.89	1.02
11	5.40	1.05	5.39	1.08	5.39	1.10	5.38	1.12
12	5.89	1.14	5.88	1.17	5.88	1.20	5.87	1.22
13	6.38	1.24	6.37	1.27	6.37	1.30	6.36	1.32
14	6.87	1.34	6.86	1.37	6.86	1.39	6.85	1.43
15	7.36	1.43	7.36	1.46	7.35	1.49	7.34	1.53
16	7.85	1.53	7.85	1.56	7.84	1.59	7.83	1.63
17	8.34	1.62	8.34	1.66	8.33	1.69	8.32	1.73
18	8.83	1.72	8.83	1.75	8.82	1.79	8.81	1.83
19	9.33	1.81	9.32	1.85	9.31	1.89	9.30	1.93
20	9.82	1.91	9.81	1.95	9.80	1.99	9.79	2.04
21	10.31	2.00	10.30	2.05	10.29	2.09	10.28	2.14
22	10.80	2.10	10.79	2.15	10.78	2.19	10.77	2.24
23	11.29	2.19	11.28	2.24	11.27	2.29	11.26	2.34
24	11.78	2.29	11.77	2.34	11.76	2.39	11.75	2.44
25	12.27	2.38	12.26	2.44	12.25	2.49	12.24	2.55
26	12.76	2.48	12.75	2.54	12.74	2.59	12.73	2.65
27	13.25	2.57	13.24	2.63	13.23	2.69	13.22	2.75
28	13.74	2.67	13.73	2.73	13.72	2.79	13.71	2.85
29	14.23	2.76	14.22	2.83	14.21	2.89	14.20	2.95
30	14.72	2.86	14.71	2.93	14.70	2.99	14.69	3.05
31	15.21	2.96	15.20	3.03	15.19	3.09	15.18	3.16
32	15.70	3.05	15.69	3.12	15.68	3.19	15.67	3.26
33	16.20	3.15	16.18	3.22	16.17	3.29	16.15	3.36
34	16.69	3.24	16.67	3.32	16.66	3.39	16.64	3.46
35	17.18	3.34	17.16	3.42	17.15	3.49	17.13	3.56
36	17.67	3.43	17.66	3.51	17.64	3.59	17.62	3.67
37	18.16	3.53	18.15	3.61	18.13	3.69	18.11	3.77
38	18.65	3.62	18.64	3.71	18.62	3.79	18.60	3.87
39	19.14	3.72	19.13	3.80	19.11	3.89	19.09	3.97
40	19.63	3.82	19.62	3.90	19.60	3.99	19.58	4.07
41	20.12	3.91	20.11	4.00	20.09	4.09	20.07	4.18
42	20.61	4.01	20.60	4.10	20.58	4.19	20.56	4.28
43	21.10	4.10	21.09	4.20	21.07	4.29	21.05	4.38
44	21.60	4.20	21.58	4.29	21.56	4.39	21.54	4.48
45	22.09	4.29	22.07	4.39	22.05	4.49	22.03	4.58
46	22.58	4.39	22.56	4.49	22.54	4.58	22.52	4.68
47	23.07	4.48	23.05	4.59	23.03	4.68	23.01	4.79
48	23.56	4.58	23.54	4.68	23.52	4.78	23.50	4.89
49	24.05	4.67	24.03	4.78	24.01	4.88	23.99	4.99
50	24.54	4.77	24.52	4.88	24.50	4.98	24.48	5.09

^a p. ch.	12	78	12 ¹ / ₄	77 ³ / ₄	12 ¹ / ₂	77 ¹ / ₂	12 ³ / ₄	77 ¹ / ₄
6	2.93	0.62	2.93	0.64	2.93	0.65	2.93	0.66
7	3.42	0.73	3.42	0.74	3.42	0.76	3.41	0.77
8	3.91	0.83	3.91	0.85	3.90	0.87	3.90	0.88
9	4.40	0.94	4.40	0.95	4.39	0.97	4.39	0.99
10	4.89	1.04	4.89	1.06	4.88	1.08	4.88	1.10
11	5.38	1.14	5.37	1.17	5.37	1.19	5.36	1.21
12	5.87	1.25	5.86	1.27	5.86	1.30	5.85	1.32
13	6.36	1.35	6.35	1.38	6.34	1.41	6.34	1.43
14	6.85	1.46	6.84	1.49	6.83	1.52	6.83	1.54
15	7.34	1.56	7.33	1.59	7.32	1.62	7.32	1.65
16	7.83	1.66	7.82	1.70	7.81	1.73	7.80	1.77
17	8.31	1.77	8.31	1.80	8.30	1.84	8.29	1.88
18	8.80	1.87	8.79	1.91	8.79	1.95	8.78	1.99
19	9.29	1.98	9.28	2.01	9.27	2.06	9.27	2.10
20	9.78	2.08	9.77	2.12	9.76	2.16	9.75	2.21
21	10.27	2.18	10.26	2.23	10.25	2.27	10.24	2.32
22	10.76	2.29	10.75	2.33	10.74	2.38	10.73	2.43
23	11.25	2.39	11.24	2.44	11.23	2.49	11.22	2.54
24	11.74	2.49	11.73	2.54	11.71	2.60	11.70	2.65
25	12.23	2.60	12.22	2.65	12.20	2.70	12.19	2.76
26	12.72	2.70	12.71	2.76	12.69	2.81	12.68	2.87
27	13.21	2.81	13.20	2.86	13.18	2.92	13.17	2.98
28	13.69	2.91	13.68	2.97	13.67	3.03	13.66	3.09
29	14.18	3.02	14.17	3.08	14.15	3.14	14.14	3.20
30	14.67	3.12	14.66	3.18	14.64	3.25	14.63	3.31
31	15.16	3.22	15.15	3.29	15.13	3.35	15.12	3.42
32	15.65	3.33	15.64	3.39	15.62	3.46	15.61	3.53
33	16.14	3.43	16.13	3.50	16.11	3.57	16.09	3.64
34	16.63	3.53	16.61	3.61	16.60	3.68	16.58	3.75
35	17.12	3.64	17.10	3.71	17.08	3.79	17.07	3.86
36	17.61	3.74	17.59	3.82	17.57	3.90	17.56	3.97
37	18.10	3.85	18.08	3.92	18.06	4.00	18.04	4.08
38	18.58	3.95	18.57	4.03	18.55	4.11	18.53	4.19
39	19.07	4.05	19.05	4.14	19.04	4.22	19.02	4.30
40	19.56	4.16	19.54	4.24	19.53	4.33	19.51	4.41
41	20.05	4.26	20.03	4.35	20.01	4.44	20.00	4.52
42	20.54	4.37	20.52	4.46	20.50	4.55	20.48	4.63
43	21.03	4.47	21.01	4.56	20.99	4.65	20.97	4.74
44	21.52	4.57	21.50	4.67	21.48	4.76	21.46	4.85
45	22.01	4.68	21.99	4.77	21.97	4.87	21.95	4.96
46	22.50	4.78	22.48	4.88	22.46	4.98	22.44	5.08
47	22.99	4.88	22.97	4.99	22.94	5.09	22.92	5.19
48	23.48	4.99	23.45	5.09	23.43	5.19	23.41	5.30
49	23.96	5.09	23.94	5.20	23.92	5.30	23.90	5.41
50	24.45	5.20	24.43	5.30	24.41	5.41	24.38	5.52

ap. ch.	I 3	77	I 3 $\frac{1}{2}$	76 $\frac{1}{2}$	I 3 $\frac{1}{2}$	76 $\frac{1}{2}$	I 3 $\frac{1}{2}$	76 $\frac{1}{2}$
6	2.92	0.67	2.92	0.69	2.92	0.70	2.91	0.71
7	3.41	0.79	3.41	0.80	3.40	0.82	3.40	0.83
8	3.90	0.90	3.89	0.92	3.89	0.93	3.89	0.95
9	4.38	1.01	4.38	1.03	4.37	1.05	4.37	1.07
10	4.87	1.12	4.87	1.14	4.86	1.17	4.86	1.19
11	5.36	1.24	5.35	1.26	5.35	1.28	5.34	1.31
12	5.85	1.35	5.84	1.38	5.83	1.40	5.83	1.43
13	6.33	1.46	6.33	1.49	6.32	1.52	6.31	1.55
14	6.82	1.57	6.81	1.60	6.81	1.63	6.80	1.66
15	7.31	1.69	7.30	1.72	7.29	1.75	7.28	1.78
16	7.79	1.80	7.79	1.83	7.78	1.87	7.77	1.90
17	8.28	1.91	8.27	1.95	8.26	1.98	8.26	2.02
18	8.77	2.02	8.76	2.06	8.75	2.10	8.74	2.14
19	9.26	2.13	9.25	2.18	9.24	2.22	9.23	2.26
20	9.74	2.25	9.73	2.29	9.72	2.33	9.71	2.38
21	10.23	2.36	10.22	2.41	10.21	2.45	10.20	2.50
22	10.72	2.47	10.71	2.52	10.70	2.56	10.69	2.61
23	11.20	2.59	11.19	2.63	11.18	2.68	11.17	2.73
24	11.69	2.70	11.68	2.75	11.67	2.80	11.66	2.85
25	12.18	2.81	12.17	2.86	12.15	2.92	12.14	2.97
26	12.67	2.92	12.65	2.98	12.64	3.03	12.63	3.09
27	13.15	3.04	13.14	3.09	13.13	3.15	13.11	3.21
28	13.64	3.15	13.63	3.21	13.61	3.27	13.60	3.33
29	14.13	3.26	14.12	3.32	14.10	3.38	14.09	3.44
30	14.62	3.37	14.60	3.44	14.59	3.50	14.57	3.56
31	15.10	3.49	15.09	3.55	15.07	3.62	15.06	3.68
32	15.59	3.60	15.57	3.67	15.56	3.73	15.54	3.80
33	16.08	3.71	16.06	3.78	16.04	3.85	16.03	3.92
34	16.56	3.82	16.55	3.89	16.53	3.97	16.51	4.04
35	17.05	3.94	17.03	4.01	17.01	4.09	17.00	4.16
36	17.54	4.05	17.52	4.13	17.50	4.20	17.48	4.28
37	18.03	4.16	18.01	4.24	17.99	4.32	17.98	4.40
38	18.51	4.27	18.49	4.35	18.47	4.43	18.46	4.52
39	19.00	4.39	18.98	4.47	18.96	4.55	18.94	4.64
40	19.49	4.50	19.47	4.58	19.45	4.67	19.43	4.75
41	19.97	4.61	19.95	4.70	19.93	4.78	19.91	4.87
42	20.46	4.72	20.34	4.81	20.42	4.90	20.40	4.99
43	20.95	4.84	20.93	4.92	20.91	5.02	20.88	5.11
44	21.43	4.95	21.41	5.04	21.39	5.13	21.37	5.23
45	21.92	5.06	21.90	5.15	21.88	5.25	21.86	5.35
46	22.41	5.17	22.39	5.26	22.36	5.37	22.34	5.47
47	22.90	5.29	22.87	5.38	22.85	5.48	22.83	5.58
48	23.38	5.40	23.36	5.50	23.34	5.60	23.31	5.70
49	23.87	5.51	23.85	5.61	23.82	5.72	23.80	5.82
50	24.36	5.62	24.33	5.73	24.31	5.84	24.28	5.94

2p. ch.	I 4	76	I 4½	75½	I 4¾	75¾	I 4⅞	75⅞
6	2.91	0.73	2.91	0.74	2.90	0.75	2.90	0.76
7	3.40	0.85	3.39	0.86	3.39	0.88	3.39	0.89
8	3.88	0.97	3.88	0.98	3.87	1.00	3.87	1.02
9	4.37	1.09	4.36	1.11	4.36	1.12	4.35	1.15
10	4.85	1.21	4.85	1.23	4.84	1.25	4.84	1.27
11	5.34	1.33	5.33	1.35	5.33	1.38	5.32	1.40
12	5.82	1.45	5.82	1.47	5.81	1.50	5.80	1.53
13	6.31	1.57	6.30	1.60	6.29	1.63	6.29	1.65
14	6.79	1.69	6.78	1.72	6.78	1.75	6.77	1.78
15	7.28	1.81	7.27	1.84	7.26	1.88	7.25	1.91
16	7.76	1.94	7.75	1.97	7.75	2.00	7.74	2.04
17	8.25	2.06	8.24	2.09	8.23	2.13	8.22	2.16
18	8.73	2.18	8.72	2.22	8.71	2.25	8.70	2.29
19	9.22	2.30	9.21	2.34	9.20	2.38	9.19	2.42
20	9.70	2.42	9.69	2.46	9.68	2.50	9.67	2.55
21	10.19	2.54	10.18	2.58	10.17	2.63	10.15	2.67
22	10.67	2.66	10.66	2.71	10.65	2.75	10.64	2.80
23	11.16	2.78	11.15	2.83	11.13	2.88	11.12	2.93
24	11.64	2.90	11.63	2.95	11.62	3.00	11.60	3.06
25	12.13	3.02	12.11	3.08	12.10	3.13	12.09	3.18
26	12.61	3.15	12.60	3.20	12.59	3.25	12.57	3.31
27	13.10	3.26	13.08	3.32	13.07	3.38	13.06	3.44
28	13.58	3.39	13.57	3.45	13.55	3.50	13.54	3.56
29	14.07	3.51	14.05	3.57	14.04	3.63	14.02	3.69
30	14.55	3.63	14.54	3.69	14.52	3.76	14.50	3.82
31	15.04	3.75	15.02	3.82	15.01	3.88	14.99	3.95
32	15.53	3.87	15.51	3.94	15.49	4.00	15.47	4.07
33	16.01	3.99	15.99	4.06	15.97	4.13	15.96	4.20
34	16.50	4.11	16.48	4.18	16.46	4.25	16.44	4.33
35	16.98	4.23	16.96	4.31	16.94	4.38	16.93	4.45
36	17.47	4.35	17.45	4.43	17.43	4.51	17.41	4.58
37	17.95	4.47	17.93	4.55	17.91	4.63	17.89	4.71
38	18.44	4.59	18.42	4.68	18.40	4.76	18.37	4.84
39	18.92	4.72	18.90	4.80	18.88	4.88	18.86	4.96
40	19.41	4.84	19.39	4.92	19.36	5.01	19.34	5.09
41	19.89	4.96	19.87	5.05	19.85	5.13	19.83	5.22
42	20.38	5.08	20.35	5.17	20.33	5.26	20.31	5.34
43	20.86	5.20	20.84	5.29	20.81	5.38	20.79	5.47
44	21.35	5.32	21.32	5.42	21.30	5.51	21.28	5.60
45	21.83	5.44	21.81	5.54	21.78	5.63	21.76	5.73
46	22.32	5.56	22.29	5.66	22.27	5.76	22.25	5.85
47	22.80	5.68	22.78	5.78	22.75	5.88	22.73	5.98
48	23.29	5.81	23.26	5.91	23.23	6.01	23.21	6.11
49	23.77	5.93	23.75	6.03	23.72	6.13	23.69	6.24
50	24.26	6.05	24.23	6.15	24.20	6.26	24.18	6.36

² p. ch.	15	75	15 $\frac{1}{4}$	74 $\frac{3}{4}$	15 $\frac{1}{2}$	74 $\frac{1}{2}$	15 $\frac{3}{4}$	74 $\frac{1}{4}$
6	2.90	0.77	2.89	0.79	2.89	0.80	2.89	0.81
7	3.38	0.90	3.38	0.92	3.37	0.94	3.37	0.95
8	3.86	1.04	3.86	1.05	3.85	1.07	3.85	1.08
9	4.35	1.16	4.34	1.18	4.34	1.20	4.33	1.22
10	4.83	1.29	4.82	1.32	4.82	1.34	4.81	1.36
11	5.31	1.42	5.31	1.45	5.30	1.47	5.29	1.49
12	5.80	1.55	5.79	1.58	5.78	1.60	5.77	1.63
13	6.28	1.68	6.27	1.71	6.26	1.74	6.25	1.76
14	6.76	1.81	6.75	1.84	6.75	1.87	6.74	1.90
15	7.24	1.94	7.24	1.97	7.23	2.00	7.22	2.04
16	7.73	2.07	7.72	2.10	7.71	2.14	7.70	2.17
17	8.21	2.20	8.20	2.24	8.19	2.27	8.18	2.31
18	8.69	2.33	8.68	2.37	8.67	2.41	8.66	2.44
19	9.18	2.46	9.17	2.50	9.15	2.54	9.14	2.58
20	9.66	2.58	9.65	2.63	9.64	2.67	9.62	2.71
21	10.14	2.72	10.13	2.76	10.12	2.81	10.10	2.85
22	10.63	2.85	10.61	2.89	10.60	2.94	10.59	2.99
23	11.11	2.98	11.09	3.02	11.08	3.07	11.07	3.12
24	11.59	3.11	11.58	3.16	11.56	3.21	11.55	3.26
25	12.07	3.24	12.06	3.29	12.04	3.34	12.03	3.39
26	12.56	3.36	12.54	3.42	12.53	3.47	12.51	3.53
27	13.04	3.49	13.02	3.55	13.01	3.61	12.99	3.67
28	13.52	3.62	13.50	3.68	13.49	3.74	13.47	3.80
29	14.01	3.75	13.99	3.81	13.97	3.87	13.96	3.94
30	14.49	3.88	14.47	3.95	14.45	4.01	14.44	4.07
31	14.97	4.01	14.95	4.08	14.93	4.14	14.92	4.21
32	15.45	4.14	15.44	4.21	15.42	4.28	15.40	4.34
33	15.94	4.27	15.92	4.34	15.90	4.41	15.88	4.48
34	16.42	4.40	16.40	4.47	16.38	4.54	16.36	4.61
35	16.90	4.53	16.88	4.60	16.86	4.68	16.84	4.75
36	17.39	4.66	17.37	4.73	17.35	4.81	17.32	4.89
37	17.87	4.79	17.85	4.86	17.83	4.94	17.81	5.02
38	18.35	4.92	18.33	5.00	18.31	5.08	18.29	5.16
39	18.84	5.05	18.81	5.13	18.79	5.21	18.77	5.29
40	19.32	5.18	19.30	5.26	19.27	5.35	19.25	5.43
41	19.80	5.31	19.78	5.39	19.75	5.48	19.73	5.56
42	20.28	5.44	20.26	5.52	20.24	5.61	20.21	5.70
43	20.77	5.56	20.74	5.65	20.71	5.74	20.69	5.84
44	21.25	5.69	21.22	5.79	21.19	5.88	21.17	5.97
45	21.73	5.82	21.71	5.91	21.68	6.01	21.65	6.11
46	22.22	5.95	22.19	6.05	22.16	6.14	22.14	6.24
47	22.70	6.08	22.67	6.18	22.64	6.28	22.62	6.38
48	23.18	6.21	23.16	6.31	23.13	6.41	23.10	6.51
49	23.66	6.34	23.64	6.44	23.61	6.55	23.58	6.65
50	24.15	6.47	24.12	6.57	24.09	6.68	24.06	6.79

Tables of Right-Angled Triangles, &c.

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² p. ch.	16	74	16 $\frac{1}{2}$	73 $\frac{3}{4}$	16 $\frac{1}{4}$	73 $\frac{1}{2}$	16 $\frac{3}{4}$	73 $\frac{1}{4}$
6	2.88	0.83	2.88	0.84	2.88	0.85	2.87	0.86
7	3.36	0.96	3.36	0.98	3.36	0.99	3.35	1.01
8	3.85	1.10	3.84	1.12	3.83	1.14	3.83	1.15
9	4.33	1.24	4.32	1.26	4.31	1.28	4.31	1.30
10	4.81	1.38	4.80	1.40	4.79	1.42	4.79	1.44
11	5.29	1.52	5.28	1.54	5.27	1.56	5.27	1.58
12	5.77	1.65	5.76	1.68	5.75	1.70	5.74	1.73
13	6.25	1.79	6.24	1.82	6.23	1.85	6.22	1.87
14	6.73	1.93	6.72	1.96	6.71	1.99	6.70	2.02
15	7.21	2.07	7.20	2.10	7.19	2.13	7.18	2.16
16	7.69	2.21	7.68	2.24	7.67	2.27	7.66	2.31
17	8.17	2.34	8.16	2.38	8.15	2.41	8.14	2.45
18	8.65	2.48	8.64	2.52	8.63	2.56	8.62	2.59
19	9.13	2.62	9.12	2.66	9.11	2.70	9.10	2.74
20	9.61	2.76	9.60	2.80	9.59	2.84	9.58	2.88
21	10.09	2.90	10.08	2.94	10.07	2.98	10.05	3.03
22	10.57	3.03	10.56	3.08	10.55	3.12	10.53	3.17
23	11.05	3.17	11.04	3.22	11.03	3.27	11.01	3.31
24	11.53	3.31	11.52	3.36	11.50	3.41	11.49	3.46
25	12.02	3.44	12.00	3.50	11.98	3.55	11.97	3.60
26	12.50	3.58	12.48	3.64	12.46	3.69	12.45	3.75
27	12.98	3.72	12.96	3.78	12.94	3.83	12.93	3.89
28	13.46	3.86	13.44	3.92	13.42	3.98	13.40	4.03
29	13.94	4.00	13.92	4.06	13.90	4.12	13.88	4.18
30	14.42	4.13	14.40	4.20	14.38	4.26	14.36	4.32
31	14.90	4.27	14.88	4.34	14.86	4.40	14.84	4.47
32	15.38	4.41	15.36	4.48	15.34	4.54	15.32	4.61
33	15.86	4.55	15.84	4.62	15.82	4.69	15.80	4.75
34	16.34	4.68	16.32	4.76	16.30	4.83	16.28	4.90
35	16.82	4.82	16.80	4.90	16.78	4.97	16.76	5.04
36	17.30	4.96	17.28	5.04	17.26	5.11	17.24	5.19
37	17.78	5.10	17.76	5.18	17.74	5.25	17.72	5.33
38	18.26	5.24	18.24	5.32	18.22	5.40	18.19	5.47
39	18.74	5.38	18.72	5.46	18.70	5.54	18.67	5.62
40	19.23	5.51	19.20	5.60	19.18	5.68	19.15	5.76
41	19.71	5.65	19.68	5.74	19.66	5.82	19.63	5.91
42	20.19	5.79	20.16	5.88	20.14	5.96	20.11	6.05
43	20.67	5.93	20.64	6.02	20.61	6.11	20.59	6.20
44	21.15	6.06	21.12	6.16	21.09	6.25	21.06	6.34
45	21.63	6.20	21.60	6.30	21.57	6.39	21.54	6.48
46	22.11	6.34	22.08	6.44	22.05	6.53	22.02	6.63
47	22.59	6.48	22.56	6.58	22.53	6.67	22.50	6.77
48	23.07	6.61	23.04	6.71	23.01	6.82	22.98	6.92
49	23.55	6.75	23.52	6.86	23.49	6.96	23.46	7.06
50	24.03	6.89	24.00	7.00	23.97	7.10	23.94	7.20

² P. ch.	17	73	17 $\frac{1}{4}$	72 $\frac{1}{4}$	17 $\frac{1}{2}$	72 $\frac{1}{2}$	17 $\frac{3}{4}$	72 $\frac{3}{4}$
6	2.87	0.88	2.86	0.89	2.86	0.90	2.86	0.91
7	3.35	1.02	3.34	1.04	3.34	1.05	3.33	1.07
8	3.82	1.17	3.82	1.19	3.81	1.20	3.81	1.22
9	4.30	1.32	4.30	1.33	4.29	1.35	4.29	1.37
10	4.78	1.46	4.78	1.48	4.77	1.50	4.76	1.52
11	5.26	1.61	5.25	1.63	5.25	1.65	5.24	1.68
12	5.74	1.75	5.73	1.78	5.72	1.80	5.71	1.83
13	6.22	1.90	6.21	1.93	6.20	1.95	6.19	1.98
14	6.69	2.05	6.68	2.08	6.68	2.10	6.67	2.13
15	7.17	2.19	7.16	2.22	7.15	2.25	7.14	2.29
16	7.65	2.34	7.64	2.37	7.63	2.40	7.62	2.44
17	8.13	2.48	8.12	2.52	8.11	2.55	8.10	2.59
18	8.61	2.63	8.59	2.65	8.58	2.71	8.57	2.74
19	9.08	2.78	9.07	2.82	9.06	2.86	9.05	2.89
20	9.56	2.92	9.55	2.97	9.54	3.01	9.52	3.05
21	10.04	3.07	10.03	3.11	10.01	3.16	10.00	3.20
22	10.52	3.21	10.51	3.26	10.49	3.31	10.48	3.35
23	11.00	3.35	10.98	3.41	10.97	3.46	10.95	3.50
24	11.47	3.51	11.46	3.56	11.44	3.61	11.43	3.66
25	11.95	3.66	11.94	3.71	11.92	3.76	11.90	3.81
26	12.43	3.80	12.42	3.85	12.40	3.91	12.38	3.96
27	12.91	3.95	12.89	4.00	12.88	4.06	12.86	4.11
28	13.39	4.10	13.37	4.15	13.35	4.21	13.33	4.27
29	13.86	4.25	13.85	4.30	13.83	4.36	13.81	4.42
30	14.34	4.39	14.33	4.45	14.31	4.51	14.29	4.57
31	14.82	4.53	14.80	4.59	14.78	4.66	14.76	4.73
32	15.30	4.68	15.28	4.74	15.26	4.81	15.24	4.87
33	15.78	4.83	15.76	4.89	15.74	4.96	15.71	5.03
34	16.26	4.98	16.24	5.04	16.21	5.11	16.19	5.17
35	16.73	5.13	16.71	5.19	16.69	5.26	16.67	5.33
36	17.21	5.26	17.19	5.34	17.17	5.41	17.14	5.49
37	17.69	5.41	17.67	5.48	17.64	5.56	17.62	5.64
38	18.17	5.56	18.15	5.63	18.12	5.71	18.10	5.79
39	18.65	5.70	18.62	5.78	18.60	5.86	18.57	5.94
40	19.13	5.84	19.10	5.93	19.07	6.01	19.05	6.10
41	19.60	5.99	19.58	6.08	19.55	6.16	19.52	6.25
42	20.08	6.14	20.06	6.23	20.03	6.31	20.00	6.40
43	20.56	6.28	20.53	6.37	20.50	6.46	20.48	6.55
44	21.04	6.43	21.01	6.52	20.98	6.61	20.95	6.71
45	21.52	6.57	21.49	6.67	21.46	6.76	21.43	6.86
46	21.99	6.72	21.96	6.82	21.93	6.91	21.90	7.01
47	22.47	6.87	22.44	6.97	22.41	7.07	22.38	7.16
48	22.95	7.02	22.92	7.12	22.89	7.22	22.86	7.32
49	23.43	7.16	23.40	7.27	23.37	7.37	23.33	7.47
50	23.91	7.31	23.88	7.41	23.84	7.52	23.81	7.62

² p. ch.	18	72	18 $\frac{1}{2}$	71 $\frac{1}{2}$	18 $\frac{1}{4}$	71 $\frac{1}{4}$	18 $\frac{3}{4}$	71 $\frac{3}{4}$
6	2.85	0.93	2.85	0.94	2.85	0.95	2.84	0.96
7	3.33	1.08	3.32	1.10	3.32	1.11	3.31	1.13
8	3.80	1.24	3.80	1.25	3.79	1.27	3.79	1.28
9	4.28	1.39	4.27	1.41	4.27	1.43	4.26	1.45
10	4.76	1.54	4.75	1.56	4.74	1.59	4.73	1.61
11	5.23	1.70	5.22	1.72	5.22	1.74	5.21	1.77
12	5.71	1.85	5.70	1.87	5.69	1.90	5.68	1.93
13	6.18	2.01	6.17	2.03	6.16	2.06	6.15	2.09
14	6.66	2.16	6.65	2.19	6.64	2.22	6.63	2.25
15	7.13	2.32	7.12	2.35	7.11	2.38	7.10	2.41
16	7.61	2.47	7.60	2.50	7.59	2.54	7.58	2.57
17	8.08	2.63	8.07	2.66	8.06	2.70	8.05	2.73
18	8.56	2.78	8.55	2.82	8.53	2.86	8.52	2.89
19	9.04	2.94	9.02	2.97	9.01	3.01	9.00	3.05
20	9.51	3.09	9.50	3.13	9.48	3.17	9.47	3.21
21	9.99	3.24	9.97	3.29	9.96	3.33	9.94	3.37
22	10.46	3.40	10.45	3.44	10.43	3.49	10.42	3.53
23	10.94	3.55	10.92	3.60	10.91	3.65	10.89	3.69
24	11.41	3.71	11.40	3.76	11.38	3.81	11.36	3.86
25	11.89	3.86	11.87	3.91	11.85	3.97	11.84	4.02
26	12.36	4.02	12.35	4.07	12.32	4.12	12.31	4.18
27	12.84	4.17	12.82	4.23	12.79	4.28	12.78	4.34
28	13.32	4.32	13.29	4.38	13.27	4.44	13.26	4.50
29	13.79	4.48	13.77	4.54	13.75	4.60	13.73	4.66
30	14.27	4.63	14.25	4.70	14.22	4.76	14.20	4.82
31	14.74	4.79	14.72	4.85	14.70	4.92	14.68	4.98
32	15.22	4.94	15.20	5.01	15.17	5.08	15.15	5.14
33	15.69	5.10	15.67	5.17	15.65	5.24	15.62	5.30
34	16.17	5.25	16.15	5.32	16.12	5.40	16.10	5.46
35	16.65	5.41	16.62	5.48	16.60	5.55	16.57	5.63
36	17.12	5.56	17.09	5.64	17.07	5.71	17.04	5.79
37	17.60	5.72	17.57	5.79	17.54	5.87	17.52	5.95
38	18.07	5.87	18.04	5.95	18.02	6.03	17.99	6.11
39	18.55	6.02	18.52	6.10	18.49	6.19	18.46	6.27
40	19.02	6.18	18.99	6.26	18.97	6.35	18.94	6.43
41	19.50	6.33	19.47	6.42	19.45	6.51	19.41	6.59
42	19.97	6.49	19.94	6.57	19.92	6.66	19.89	6.75
43	20.45	6.64	20.42	6.73	20.39	6.82	20.36	6.91
44	20.92	6.80	20.89	6.89	20.86	6.98	20.83	7.07
45	21.40	6.95	21.37	7.04	21.34	7.14	21.31	7.23
46	21.88	7.11	21.84	7.20	21.81	7.30	21.78	7.39
47	22.35	7.26	22.32	7.35	22.29	7.45	22.25	7.55
48	22.83	7.42	22.79	7.52	22.76	7.61	22.73	7.71
49	23.30	7.57	23.27	7.67	23.23	7.77	23.20	7.87
50	23.78	7.72	23.74	7.83	23.71	7.93	23.67	8.04

² P. ch.	19	71	19 $\frac{1}{2}$	70 $\frac{3}{4}$	19 $\frac{1}{2}$	70 $\frac{1}{2}$	19 $\frac{3}{4}$	70 $\frac{1}{4}$
6	2.84	0.98	2.83	0.99	2.83	1.00	2.82	1.01
7	3.31	1.14	3.30	1.15	3.30	1.17	3.30	1.18
8	3.78	1.30	3.78	1.32	3.78	1.34	3.76	1.35
9	4.25	1.46	4.25	1.48	4.24	1.50	4.23	1.52
10	4.73	1.63	4.72	1.65	4.71	1.67	4.70	1.69
11	5.20	1.79	5.19	1.81	5.18	1.84	5.17	1.86
12	5.67	1.95	5.66	1.98	5.66	2.00	5.65	2.03
13	6.15	2.11	6.14	2.14	6.13	2.17	6.12	2.20
14	6.62	2.28	6.61	2.31	6.60	2.34	6.59	2.36
15	7.09	2.44	7.08	2.47	7.07	2.50	7.06	2.53
16	7.56	2.60	7.55	2.64	7.54	2.67	7.53	2.70
17	8.04	2.77	8.02	2.80	8.01	2.84	8.00	2.87
18	8.51	2.93	8.50	2.97	8.48	3.00	8.47	3.04
19	8.98	3.09	8.97	3.13	8.95	3.17	8.94	3.21
20	9.45	3.26	9.44	3.30	9.43	3.34	9.41	3.38
21	9.93	3.42	9.91	3.46	9.90	3.50	9.88	3.55
22	10.40	3.58	10.38	3.63	10.37	3.67	10.35	3.72
23	10.88	3.74	10.86	3.79	10.84	3.84	10.82	3.89
24	11.35	3.91	11.33	3.96	11.31	4.00	11.29	4.06
25	11.82	4.07	11.80	4.12	11.78	4.17	11.76	4.22
26	12.29	4.23	12.27	4.29	12.25	4.34	12.23	4.39
27	12.76	4.39	12.74	4.45	12.72	4.50	12.70	4.56
28	13.24	4.56	13.22	4.62	13.19	4.67	13.17	4.73
29	13.71	4.72	13.69	4.78	13.66	4.84	13.64	4.90
30	14.18	4.88	14.16	4.94	14.14	5.01	14.12	5.07
31	14.66	5.04	14.63	5.11	14.61	5.17	14.59	5.24
32	15.13	5.21	15.10	5.27	15.08	5.34	15.06	5.41
33	15.60	5.37	15.58	5.44	15.55	5.51	15.53	5.58
34	16.07	5.53	16.05	5.60	16.02	5.67	16.00	5.74
35	16.55	5.70	16.52	5.77	16.49	5.84	16.47	5.91
36	17.02	5.86	16.99	5.93	16.97	6.01	16.94	6.08
37	17.49	6.02	17.46	6.10	17.44	6.17	17.41	6.25
38	17.96	6.18	17.94	6.26	17.91	6.34	17.88	6.42
39	18.44	6.35	18.41	6.43	18.38	6.51	18.35	6.59
40	18.91	6.51	18.88	6.59	18.85	6.68	18.82	6.76
41	19.38	6.67	19.35	6.76	19.32	6.84	19.29	6.93
42	19.86	6.84	19.83	6.92	19.80	7.01	19.76	7.10
43	20.33	7.00	20.30	7.09	20.27	7.18	20.23	7.26
44	20.80	7.16	20.77	7.25	20.74	7.34	20.71	7.43
45	21.27	7.32	21.24	7.42	21.21	7.51	21.18	7.60
46	21.75	7.49	21.71	7.58	21.68	7.68	21.65	7.77
47	22.22	7.65	22.19	7.75	22.15	7.85	22.12	7.94
48	22.69	7.81	22.66	7.91	22.62	8.01	22.59	8.11
49	23.16	7.97	23.13	8.08	23.09	8.18	23.06	8.28
50	23.64	8.14	23.60	8.24	23.57	8.34	23.53	8.44

² p. ch.	20	70	20 $\frac{1}{2}$	69 $\frac{1}{2}$	20 $\frac{1}{2}$	69 $\frac{1}{2}$	20 $\frac{3}{4}$	69 $\frac{1}{4}$
6	2.82	1.03	2.81	1.04	2.81	1.05	2.81	1.06
7	3.29	1.20	3.28	1.21	3.28	1.22	3.28	1.24
8	3.76	1.37	3.75	1.38	3.75	1.40	3.74	1.42
9	4.23	1.54	4.22	1.56	4.21	1.57	4.21	1.59
10	4.70	1.71	4.69	1.73	4.68	1.75	4.68	1.77
11	5.17	1.88	5.16	1.90	5.15	1.93	5.14	1.95
12	5.64	2.05	5.63	2.08	5.62	2.10	5.61	2.13
13	6.11	2.22	6.10	2.25	6.09	2.28	6.08	2.30
14	6.58	2.39	6.57	2.42	6.56	2.45	6.55	2.48
15	7.05	2.56	7.04	2.60	7.02	2.63	7.01	2.66
16	7.52	2.74	7.50	2.77	7.49	2.80	7.48	2.83
17	7.99	2.91	7.97	2.94	7.96	2.98	7.95	3.01
18	8.46	3.08	8.44	3.12	8.43	3.15	8.41	3.19
19	8.93	3.25	8.91	3.29	8.90	3.33	8.88	3.37
20	9.40	3.42	9.38	3.46	9.37	3.50	9.35	3.54
21	9.87	3.59	9.85	3.63	9.83	3.68	9.82	3.72
22	10.34	3.76	10.32	3.81	10.30	3.85	10.29	3.90
23	10.81	3.93	10.79	3.98	10.77	4.03	10.75	4.08
24	11.28	4.10	11.26	4.15	11.24	4.20	11.22	4.25
25	11.75	4.27	11.73	4.33	11.71	4.38	11.69	4.43
26	12.22	4.44	12.20	4.50	12.18	4.55	12.16	4.61
27	12.69	4.62	12.67	4.67	12.64	4.73	12.62	4.78
28	13.16	4.79	13.14	4.85	13.11	4.90	13.09	4.97
29	13.63	4.96	13.60	5.02	13.58	5.08	13.56	5.14
30	14.10	5.13	14.07	5.19	14.05	5.25	14.03	5.31
31	14.56	5.30	14.54	5.36	14.52	5.43	14.50	5.49
32	15.03	5.47	15.01	5.54	14.99	5.60	14.96	5.67
33	15.50	5.64	15.48	5.71	15.45	5.78	15.43	5.85
34	15.97	5.81	15.95	5.88	15.92	5.95	15.90	6.02
35	16.44	5.98	16.42	6.05	16.39	6.13	16.37	6.20
36	16.91	6.16	16.89	6.23	16.86	6.30	16.83	6.38
37	17.38	6.33	17.36	6.40	17.33	6.48	17.30	6.56
38	17.85	6.50	17.83	6.57	17.80	6.65	17.77	6.73
39	18.32	6.67	18.29	6.75	18.27	6.83	18.24	6.91
40	18.79	6.84	18.76	6.92	18.73	7.00	18.70	7.09
41	19.26	7.01	19.23	7.09	19.20	7.18	19.17	7.26
42	19.73	7.18	19.70	7.27	19.67	7.35	19.64	7.44
43	20.20	7.35	20.17	7.44	20.14	7.53	20.11	7.62
44	20.67	7.52	20.64	7.61	20.61	7.70	20.57	7.80
45	21.14	7.69	21.11	7.79	21.07	7.88	21.04	7.97
46	21.61	7.87	21.58	7.96	21.54	8.05	21.51	8.15
47	22.08	8.04	22.05	8.13	22.01	8.23	21.98	8.33
48	22.55	8.21	22.52	8.30	22.48	8.40	22.44	8.50
49	23.02	8.38	22.99	8.48	22.95	8.58	22.91	8.68
50	23.49	8.55	23.46	8.65	23.42	8.75	23.38	8.86

ap. ch.	2 I	69	2 I $\frac{1}{2}$	68 $\frac{1}{2}$	2 I $\frac{1}{2}$	68 $\frac{1}{2}$	2 I $\frac{1}{2}$	68 $\frac{1}{2}$
6	2.80	1.08	2.79	1.09	2.79	1.10	2.79	1.11
7	3.27	1.25	3.26	1.27	3.26	1.28	3.25	1.30
8	3.73	1.43	3.73	1.45	3.72	1.47	3.72	1.48
9	4.20	1.61	4.19	1.63	4.19	1.65	4.18	1.67
10	4.67	1.79	4.66	1.81	4.65	1.83	4.64	1.85
11	5.13	1.97	5.13	1.99	5.12	2.01	5.11	2.04
12	5.60	2.15	5.59	2.17	5.58	2.20	5.57	2.22
13	6.07	2.33	6.06	2.35	6.05	2.38	6.04	2.41
14	6.53	2.51	6.52	2.54	6.51	2.57	6.50	2.59
15	7.00	2.69	6.99	2.72	6.98	2.75	6.97	2.78
16	7.47	2.86	7.45	2.90	7.44	2.93	7.43	2.96
17	7.93	3.05	7.92	3.08	7.91	3.11	7.89	3.15
18	8.40	3.23	8.39	3.26	8.37	3.30	8.36	3.33
19	8.87	3.40	8.85	3.44	8.84	3.48	8.82	3.52
20	9.34	3.58	9.32	3.62	9.30	3.67	9.29	3.70
21	9.80	3.76	9.79	3.80	9.77	3.85	9.75	3.89
22	10.27	3.94	10.25	3.98	10.23	4.03	10.22	4.08
23	10.74	4.12	10.72	4.17	10.70	4.21	10.68	4.26
24	11.20	4.30	11.18	4.35	11.16	4.40	11.15	4.44
25	11.67	4.48	11.65	4.53	11.63	4.58	11.61	4.63
26	12.14	4.66	12.12	4.71	12.10	4.76	12.07	4.82
27	12.60	4.84	12.58	4.89	12.56	4.95	12.54	5.00
28	13.07	5.02	13.05	5.07	13.03	5.13	13.00	5.19
29	13.54	5.20	13.51	5.25	13.49	5.31	13.47	5.37
30	14.00	5.38	13.98	5.44	13.96	5.50	13.93	5.56
31	14.47	5.55	14.45	5.62	14.42	5.68	14.40	5.74
32	14.94	5.73	14.91	5.80	14.89	5.86	14.86	5.93
33	15.40	5.91	15.38	5.98	15.35	6.05	15.32	6.11
34	15.87	6.09	15.84	6.16	15.82	6.23	15.79	6.30
35	16.34	6.27	16.31	6.34	16.28	6.41	16.25	6.48
36	16.80	6.45	16.78	6.52	16.75	6.60	16.72	6.67
37	17.27	6.63	17.24	6.70	17.21	6.78	17.18	6.85
38	17.74	6.81	17.71	6.88	17.68	6.96	17.65	7.04
39	18.21	6.99	18.17	7.07	18.14	7.15	18.11	7.22
40	18.67	7.17	18.64	7.25	18.61	7.33	18.58	7.41
41	19.14	7.35	19.11	7.43	19.07	7.51	19.04	7.60
42	19.60	7.53	19.57	7.61	19.54	7.69	19.50	7.78
43	20.07	7.71	20.04	7.79	20.00	7.88	19.97	7.97
44	20.54	7.88	20.50	7.97	20.47	8.06	20.43	8.15
45	21.00	8.06	20.97	8.15	20.93	8.25	20.90	8.34
46	21.47	8.24	21.44	8.33	21.40	8.43	21.36	8.52
47	21.94	8.42	21.90	8.52	21.86	8.61	21.83	8.71
48	22.41	8.60	22.37	8.70	22.33	8.80	22.29	8.89
49	22.87	8.78	22.83	8.88	22.80	8.98	22.76	9.08
50	23.34	8.96	23.30	9.06	23.26	9.16	23.22	9.26

2 ^p . ch.	22	68	22½	67½	22½	67½	22½	67½
6	2.78	1.12	2.78	1.13	2.77	1.15	2.77	1.16
7	3.24	1.31	3.24	1.32	3.23	1.34	3.23	1.35
8	3.71	1.50	3.70	1.51	3.70	1.53	3.69	1.55
9	4.17	1.69	4.16	1.70	4.16	1.72	4.15	1.74
10	4.64	1.87	4.63	1.89	4.62	1.91	4.61	1.93
11	5.10	2.06	5.09	2.08	5.08	2.10	5.07	2.13
12	5.56	2.25	5.55	2.27	5.54	2.30	5.53	2.32
13	6.03	2.43	6.02	2.46	6.01	2.49	5.99	2.51
14	6.49	2.62	6.48	2.65	6.47	2.68	6.45	2.71
15	6.95	2.81	6.94	2.84	6.93	2.87	6.92	2.90
16	7.42	3.00	7.40	3.03	7.39	3.06	7.38	3.09
17	7.88	3.18	7.87	3.22	7.85	3.25	7.84	3.29
18	8.34	3.37	8.33	3.41	8.31	3.44	8.30	3.48
19	8.81	3.56	8.79	3.60	8.78	3.63	8.76	3.67
20	9.27	3.75	9.25	3.79	9.24	3.83	9.22	3.87
21	9.74	3.93	9.72	3.98	9.70	4.02	9.68	4.06
22	10.20	4.12	10.18	4.17	10.16	4.21	10.14	4.25
23	10.66	4.31	10.64	4.35	10.62	4.40	10.60	4.45
24	11.13	4.49	11.11	4.54	11.09	4.59	11.07	4.64
25	11.59	4.68	11.57	4.73	11.55	4.78	11.53	4.83
26	12.05	4.87	12.03	4.92	12.01	4.97	11.99	5.03
27	12.52	5.05	12.50	5.11	12.47	5.17	12.45	5.22
28	12.98	5.24	12.96	5.30	12.93	5.36	12.91	5.41
29	13.45	5.43	13.42	5.49	13.40	5.55	13.37	5.61
30	13.91	5.62	13.88	5.68	13.86	5.74	13.83	5.80
31	14.37	5.81	14.35	5.87	14.32	5.93	14.29	5.99
32	14.84	5.99	14.81	6.06	14.78	6.12	14.75	6.19
33	15.30	6.18	15.27	6.25	15.24	6.31	15.22	6.38
34	15.76	6.37	15.73	6.44	15.71	6.50	15.68	6.57
35	16.23	6.55	16.20	6.62	16.17	6.70	16.14	6.77
36	16.69	6.74	16.66	6.81	16.63	6.89	16.60	6.96
37	17.15	6.93	17.12	7.00	17.09	7.08	17.06	7.15
38	17.62	7.12	17.58	7.19	17.55	7.27	17.52	7.35
39	18.08	7.30	18.05	7.38	18.02	7.46	17.98	7.54
40	18.54	7.49	18.51	7.57	18.48	7.65	18.44	7.73
41	19.01	7.68	18.97	7.76	18.94	7.84	18.90	7.93
42	19.47	7.87	19.44	7.95	19.40	8.04	19.37	8.12
43	19.93	8.05	19.90	8.14	19.86	8.23	19.83	8.31
44	20.40	8.24	20.36	8.33	20.33	8.42	20.29	8.51
45	20.86	8.43	20.83	8.52	20.79	8.61	20.75	8.70
46	21.33	8.61	21.29	8.71	21.25	8.80	21.21	8.89
47	21.79	8.80	21.75	8.90	21.71	8.99	21.67	9.09
48	22.25	8.99	22.21	9.09	22.17	9.18	22.13	9.28
49	22.72	9.18	22.68	9.28	22.64	9.37	22.59	9.47
50	23.18	9.36	23.14	9.47	23.10	9.57	23.05	9.67

² p. ch.	23	67	23 $\frac{1}{4}$	66 $\frac{3}{4}$	23 $\frac{1}{2}$	66 $\frac{1}{2}$	23 $\frac{3}{4}$	66 $\frac{1}{4}$
6	2.76	1.17	2.76	1.18	2.75	1.20	2.74	1.21
7	3.22	1.37	3.22	1.38	3.21	1.40	3.20	1.41
8	3.68	1.56	3.67	1.58	3.67	1.59	3.66	1.61
9	4.14	1.76	4.13	1.78	4.13	1.79	4.12	1.81
10	4.60	1.95	4.59	1.97	4.59	1.99	4.58	2.01
11	5.06	2.15	5.05	2.17	5.04	2.19	5.04	2.21
12	5.52	2.34	5.51	2.37	5.50	2.39	5.49	2.42
13	5.98	2.54	5.97	2.57	5.96	2.59	5.95	2.62
14	6.44	2.74	6.43	2.76	6.42	2.79	6.41	2.82
15	6.90	2.93	6.89	2.96	6.88	2.99	6.87	3.02
16	7.36	3.13	7.35	3.16	7.34	3.19	7.32	3.22
17	7.82	3.32	7.81	3.35	7.80	3.39	7.78	3.42
18	8.28	3.52	8.27	3.55	8.25	3.58	8.24	3.62
19	8.74	3.71	8.73	3.75	8.71	3.79	8.70	3.82
20	9.20	3.91	9.19	3.95	9.17	3.99	9.15	4.03
21	9.66	4.10	9.65	4.14	9.63	4.19	9.61	4.23
22	10.12	4.30	10.11	4.34	10.09	4.39	10.07	4.43
23	10.59	4.50	10.57	4.54	10.55	4.58	10.53	4.63
24	11.05	4.69	11.03	4.74	11.00	4.78	10.98	4.83
25	11.51	4.88	11.49	4.93	11.46	4.98	11.44	5.03
26	11.97	5.08	11.94	5.13	11.92	5.18	11.90	5.23
27	12.43	5.27	12.40	5.33	12.38	5.38	12.36	5.43
28	12.89	5.47	12.86	5.52	12.84	5.58	12.81	5.64
29	13.35	5.66	13.32	5.72	13.30	5.78	13.27	5.84
30	13.81	5.86	13.78	5.92	13.76	5.98	13.73	6.04
31	14.27	6.06	14.24	6.12	14.21	6.18	14.19	6.24
32	14.73	6.25	14.70	6.32	14.67	6.38	14.65	6.44
33	15.19	6.45	15.16	6.51	15.13	6.58	15.10	6.64
34	15.65	6.64	15.62	6.71	15.59	6.78	15.56	6.84
35	16.11	6.84	16.08	6.91	16.05	6.98	16.02	7.05
36	16.57	7.03	16.54	7.10	16.51	7.18	16.47	7.25
37	17.03	7.23	17.00	7.30	16.97	7.38	16.93	7.45
38	17.49	7.42	17.46	7.50	17.43	7.58	17.39	7.65
39	17.95	7.62	17.92	7.70	17.88	7.78	17.85	7.85
40	18.41	7.82	18.38	7.90	18.34	7.98	18.31	8.05
41	18.87	8.01	18.84	8.09	18.80	8.17	18.76	8.26
42	19.33	8.21	19.29	8.29	19.26	8.37	19.22	8.46
43	19.79	8.40	19.75	8.49	19.72	8.57	19.68	8.66
44	20.25	8.60	20.21	8.68	20.18	8.77	20.14	8.86
45	20.71	8.79	20.67	8.88	20.63	8.97	20.60	9.06
46	21.17	8.99	21.13	9.08	21.09	9.17	21.05	9.26
47	21.63	9.18	21.59	9.28	21.55	9.37	21.51	9.46
48	22.09	9.38	22.05	9.47	22.01	9.57	21.97	9.66
49	22.55	9.57	22.51	9.67	22.47	9.77	22.43	9.86
50	23.01	9.77	22.97	9.87	22.93	9.97	22.88	10.07

² P. ch.	24	66	24 ¹ / ₄	65 ³ / ₄	24 ¹ / ₂	65 ¹ / ₂	24 ³ / ₄	65 ¹ / ₄
6	2.74	1.22	2.74	1.23	2.73	1.24	2.72	1.26
7	3.20	1.42	3.19	1.44	3.18	1.45	3.18	1.47
8	3.65	1.63	3.65	1.64	3.64	1.66	3.63	1.67
9	4.11	1.83	4.10	1.85	4.09	1.87	4.09	1.88
10	4.57	2.03	4.56	2.05	4.55	2.07	4.54	2.09
11	5.02	2.24	5.01	2.26	5.00	2.28	4.99	2.30
12	5.48	2.44	5.47	2.46	5.46	2.49	5.45	2.51
13	5.94	2.64	5.93	2.67	5.91	2.70	5.90	2.72
14	6.39	2.85	6.38	2.88	6.37	2.90	6.36	2.93
15	6.85	3.05	6.84	3.08	6.82	3.11	6.81	3.14
16	7.31	3.25	7.29	3.29	7.28	3.32	7.26	3.35
17	7.76	3.46	7.75	3.49	7.73	3.52	7.72	3.56
18	8.22	3.66	8.20	3.70	8.19	3.73	8.17	3.77
19	8.68	3.86	8.66	3.90	8.64	3.94	8.63	3.98
20	9.13	4.07	9.12	4.10	9.10	4.15	9.08	4.19
21	9.59	4.27	9.57	4.31	9.55	4.35	9.54	4.40
22	10.05	4.47	10.03	4.51	10.01	4.56	9.99	4.60
23	10.51	4.68	10.48	4.72	10.46	4.77	10.44	4.81
24	10.96	4.88	10.94	4.93	10.92	4.98	10.90	5.02
25	11.42	5.08	11.40	5.13	11.37	5.19	11.35	5.23
26	11.88	5.29	11.85	5.34	11.83	5.39	11.81	5.44
27	12.33	5.49	12.31	5.54	12.28	5.60	12.26	5.65
28	12.79	5.69	12.76	5.75	12.74	5.81	12.71	5.86
29	13.25	5.90	13.22	5.95	13.19	6.01	13.17	6.07
30	13.70	6.10	13.68	6.16	13.65	6.22	13.62	6.28
31	14.16	6.30	14.13	6.37	14.10	6.43	14.08	6.49
32	14.62	6.51	14.59	6.57	14.56	6.63	14.53	6.70
33	15.07	6.71	15.04	6.78	15.01	6.84	14.98	6.91
34	15.53	6.91	15.50	6.98	15.47	7.05	15.44	7.12
35	15.99	7.12	15.95	7.19	15.92	7.26	15.89	7.33
36	16.44	7.32	16.41	7.39	16.38	7.46	16.35	7.53
37	16.90	7.52	16.87	7.60	16.83	7.67	16.80	7.75
38	17.36	7.73	17.32	7.80	17.29	7.88	17.25	7.96
39	17.81	7.93	17.78	8.01	17.74	8.09	17.71	8.16
40	18.27	8.14	18.24	8.21	18.20	8.29	18.16	8.37
41	18.73	8.34	18.69	8.42	18.65	8.50	18.62	8.58
42	19.18	8.54	19.15	8.62	19.11	8.71	19.07	8.79
43	19.64	8.74	19.60	8.83	19.56	8.92	19.52	9.00
44	20.10	8.95	20.06	9.03	20.02	9.12	19.98	9.21
45	20.55	9.15	20.51	9.24	20.47	9.33	20.43	9.42
46	21.01	9.35	20.97	9.45	20.93	9.54	20.89	9.63
47	21.47	9.56	21.42	9.65	21.38	9.74	21.34	9.84
48	21.92	9.76	21.88	9.86	21.84	9.95	21.79	10.05
49	22.38	9.97	22.34	10.06	22.29	10.16	22.25	10.26
50	22.84	10.17	22.79	10.27	22.75	10.37	22.70	10.47

² P. ch.	25	65	25 ¹ / ₂	64 ³ / ₄	25 ¹ / ₂	64 ¹ / ₂	25 ³ / ₄	64 ¹ / ₄
6	2.72	1.27	2.71	1.28	2.71	1.29	2.70	1.30
7	3.17	1.48	3.17	1.49	3.16	1.51	3.15	1.52
8	3.63	1.69	3.62	1.71	3.61	1.72	3.60	1.74
9	4.08	1.90	4.07	1.92	4.06	1.94	4.05	1.95
10	4.53	2.11	4.52	2.13	4.51	2.15	4.50	2.17
11	4.98	2.32	4.97	2.34	4.96	2.37	4.95	2.39
12	5.44	2.53	5.43	2.56	5.42	2.58	5.40	2.61
13	5.89	2.75	5.88	2.77	5.87	2.80	5.85	2.82
14	6.34	2.96	6.33	2.99	6.32	3.01	6.30	3.04
15	6.80	3.17	6.78	3.20	6.77	3.23	6.75	3.26
16	7.25	3.38	7.24	3.41	7.22	3.44	7.21	3.47
17	7.70	3.59	7.69	3.62	7.67	3.66	7.66	3.69
18	8.16	3.80	8.14	3.84	8.12	3.87	8.11	3.91
19	8.61	4.01	8.59	4.05	8.57	4.09	8.56	4.13
20	9.06	4.23	9.04	4.27	9.03	4.30	9.01	4.34
21	9.52	4.44	9.50	4.48	9.48	4.52	9.46	4.56
22	9.97	4.65	9.95	4.69	9.93	4.74	9.91	4.78
23	10.42	4.86	10.40	4.90	10.38	4.95	10.36	4.99
24	10.87	5.07	10.85	5.12	10.83	5.17	10.81	5.21
25	11.33	5.28	11.30	5.33	11.28	5.38	11.26	5.43
26	11.78	5.49	11.76	5.54	11.73	5.60	11.71	5.65
27	12.23	5.70	12.21	5.76	12.18	5.81	12.16	5.86
28	12.69	5.91	12.66	5.97	12.63	6.03	12.61	6.08
29	13.14	6.13	13.11	6.18	13.09	6.24	13.06	6.30
30	13.59	6.34	13.57	6.40	13.54	6.46	13.51	6.52
31	14.05	6.55	14.02	6.61	13.99	6.67	13.96	6.73
32	14.50	6.76	14.47	6.83	14.44	6.89	14.41	6.95
33	14.96	6.97	14.92	7.04	14.89	7.10	14.86	7.17
34	15.41	7.18	15.37	7.25	15.34	7.32	15.31	7.38
35	15.86	7.39	15.83	7.46	15.80	7.53	15.76	7.60
36	16.31	7.61	16.28	7.68	16.25	7.75	16.21	7.82
37	16.77	7.82	16.73	7.89	16.70	7.96	16.66	8.04
38	17.22	8.03	17.18	8.10	17.15	8.18	17.11	8.25
39	17.67	8.24	17.64	8.32	17.60	8.39	17.56	8.47
40	18.13	8.45	18.09	8.53	18.05	8.61	18.01	8.69
41	18.58	8.66	18.54	8.74	18.50	8.83	18.46	8.91
42	19.03	8.88	18.99	8.96	18.95	9.04	18.91	9.12
43	19.49	9.09	19.44	9.17	19.40	9.26	19.36	9.34
44	19.94	9.30	19.90	9.38	19.86	9.47	19.81	9.56
45	20.39	9.51	20.35	9.60	20.31	9.69	20.26	9.77
46	20.85	9.72	20.80	9.81	20.76	9.90	20.71	9.99
47	21.30	9.93	21.25	10.02	21.21	10.12	21.17	10.21
48	21.75	10.14	21.71	10.24	21.66	10.33	21.62	10.42
49	22.20	10.36	22.16	10.45	22.11	10.55	22.07	10.64
50	22.66	10.57	22.61	10.66	22.56	10.76	22.52	10.86

² p. ch.	26	64	26 $\frac{1}{2}$	63 $\frac{3}{4}$	26 $\frac{1}{2}$	63 $\frac{1}{2}$	26 $\frac{3}{4}$	63 $\frac{1}{4}$
6	2.70	1.31	2.69	1.33	2.68	1.34	2.68	1.35
7	3.15	1.53	3.14	1.55	3.13	1.56	3.12	1.58
8	3.60	1.75	3.59	1.77	3.58	1.78	3.57	1.80
9	4.05	1.97	4.04	1.99	4.03	2.01	4.02	2.02
10	4.49	2.19	4.48	2.21	4.47	2.23	4.46	2.25
11	4.94	2.41	4.93	2.43	4.92	2.45	4.91	2.47
12	5.39	2.63	5.38	2.65	5.37	2.68	5.36	2.70
13	5.84	2.85	5.83	2.87	5.82	2.90	5.80	2.93
14	6.29	3.07	6.28	3.10	6.26	3.12	6.25	3.15
15	6.74	3.29	6.73	3.32	6.71	3.35	6.70	3.37
16	7.19	3.51	7.17	3.54	7.16	3.57	7.14	3.60
17	7.64	3.73	7.62	3.76	7.61	3.79	7.59	3.83
18	8.09	3.94	8.07	3.98	8.05	4.02	8.04	4.05
19	8.54	4.16	8.52	4.20	8.50	4.24	8.48	4.28
20	8.99	4.38	8.97	4.42	8.95	4.46	8.93	4.50
21	9.44	4.60	9.42	4.64	9.40	4.69	9.38	4.72
22	9.89	4.82	9.87	4.86	9.84	4.91	9.82	4.95
23	10.34	5.04	10.31	5.09	10.29	5.13	10.27	5.17
24	10.79	5.26	10.76	5.31	10.74	5.35	10.72	5.40
25	11.23	5.48	11.21	5.53	11.19	5.58	11.16	5.63
26	11.68	5.70	11.66	5.75	11.63	5.80	11.61	5.85
27	12.13	5.92	12.11	5.97	12.08	6.02	12.05	6.08
28	12.58	6.14	12.56	6.19	12.53	6.25	12.50	6.30
29	13.03	6.36	13.00	6.41	12.97	6.47	12.95	6.53
30	13.48	6.58	13.45	6.63	13.42	6.69	13.39	6.75
31	13.93	6.79	13.90	6.85	13.87	6.92	13.84	6.98
32	14.38	7.01	14.35	7.08	14.32	7.14	14.29	7.20
33	14.83	7.23	14.80	7.30	14.77	7.36	14.73	7.43
34	15.28	7.45	15.25	7.52	15.21	7.59	15.18	7.65
35	15.73	7.67	15.69	7.74	15.66	7.81	15.62	7.88
36	16.18	7.89	16.14	7.96	16.11	8.03	16.07	8.10
37	16.63	8.11	16.59	8.18	16.56	8.25	16.52	8.33
38	17.08	8.33	17.04	8.40	17.00	8.48	16.97	8.55
39	17.53	8.55	17.49	8.62	17.45	8.70	17.41	8.78
40	17.98	8.77	17.94	8.85	17.90	8.92	17.86	9.00
41	18.43	8.99	18.39	9.07	18.35	9.15	18.31	9.23
42	18.87	9.21	18.83	9.29	18.79	9.37	18.75	9.45
43	19.32	9.42	19.28	9.51	19.24	9.59	19.20	9.68
44	19.77	9.64	19.73	9.73	19.69	9.82	19.64	9.90
45	20.22	9.86	20.18	9.95	20.13	10.04	20.09	10.13
46	20.67	10.08	20.63	10.17	20.58	10.26	20.54	10.35
47	21.12	10.30	21.08	10.39	21.03	10.49	20.98	10.58
48	21.57	10.52	21.52	10.62	21.48	10.71	21.43	10.80
49	22.02	10.74	21.97	10.84	21.92	10.93	21.88	11.03
50	22.47	10.96	22.42	11.06	22.37	11.15	22.32	11.25

^{p.} ch.	27	63	27 $\frac{1}{4}$	62 $\frac{1}{4}$	27 $\frac{1}{2}$	62 $\frac{1}{2}$	27 $\frac{3}{4}$	62 $\frac{3}{4}$
6	2.67	1.36	2.67	1.37	2.66	1.39	2.65	1.40
7	3.12	1.59	3.11	1.60	3.10	1.62	3.10	1.63
8	3.56	1.82	3.56	1.83	3.55	1.85	3.54	1.86
9	4.01	2.04	4.00	2.06	3.99	2.08	3.98	2.10
10	4.45	2.27	4.44	2.29	4.43	2.31	4.42	2.33
11	4.90	2.50	4.89	2.52	4.88	2.54	4.87	2.56
12	5.35	2.72	5.33	2.75	5.32	2.77	5.31	2.79
13	5.79	2.95	5.78	2.98	5.77	3.00	5.75	3.03
14	6.24	3.18	6.22	3.21	6.21	3.23	6.19	3.26
15	6.68	3.40	6.67	3.43	6.65	3.46	6.64	3.49
16	7.13	3.63	7.11	3.66	7.10	3.69	7.08	3.72
17	7.57	3.86	7.56	3.89	7.54	3.92	7.52	3.96
18	8.02	4.08	8.00	4.12	7.98	4.16	7.96	4.19
19	8.46	4.31	8.45	4.35	8.43	4.39	8.41	4.42
20	8.91	4.54	8.89	4.58	8.87	4.62	8.85	4.66
21	9.36	4.77	9.33	4.81	9.31	4.85	9.29	4.89
22	9.80	4.99	9.78	5.04	9.76	5.08	9.73	5.12
23	10.25	5.22	10.22	5.27	10.20	5.31	10.18	5.35
24	10.69	5.45	10.67	5.49	10.64	5.54	10.62	5.59
25	11.14	5.67	11.11	5.72	11.09	5.77	11.06	5.82
26	11.58	5.90	11.56	5.95	11.53	6.00	11.50	6.05
27	12.03	6.13	12.00	6.18	11.97	6.23	11.95	6.29
28	12.47	6.36	12.45	6.41	12.42	6.46	12.39	6.52
29	12.92	6.58	12.89	6.64	12.86	6.69	12.83	6.75
30	13.37	6.81	13.33	6.87	13.30	6.93	13.28	6.98
31	13.81	7.04	13.78	7.10	13.75	7.16	13.72	7.22
32	14.26	7.26	14.22	7.33	14.19	7.39	14.16	7.45
33	14.70	7.49	14.67	7.55	14.63	7.62	14.60	7.68
34	15.15	7.72	15.11	7.78	15.08	7.85	15.04	7.91
35	15.59	7.94	15.56	8.01	15.52	8.08	15.49	8.15
36	16.04	8.17	16.00	8.24	15.97	8.31	15.93	8.38
37	16.48	8.40	16.45	8.47	16.41	8.54	16.37	8.61
38	16.93	8.63	16.89	8.70	16.85	8.77	16.81	8.85
39	17.37	8.85	17.34	8.93	17.29	9.00	17.26	9.08
40	17.82	9.08	17.78	9.16	17.74	9.24	17.70	9.31
41	18.27	9.31	18.22	9.39	18.18	9.47	18.14	9.54
42	18.71	9.53	18.67	9.61	18.63	9.70	18.58	9.78
43	19.16	9.76	19.11	9.84	19.07	9.93	19.03	10.01
44	19.60	9.99	19.56	10.07	19.51	10.16	19.47	10.24
45	20.05	10.21	20.00	10.30	19.96	10.39	19.91	10.48
46	20.49	10.44	20.45	10.53	20.40	10.62	20.35	10.71
47	20.94	10.67	20.89	10.76	20.84	10.85	20.80	10.94
48	21.38	10.90	21.34	10.99	21.29	11.08	21.24	11.17
49	21.83	11.12	21.78	11.22	21.73	11.31	21.68	11.41
50	22.27	11.35	22.22	11.45	22.17	11.54	22.12	11.64

² P. ch.	28	62	28 $\frac{1}{4}$	61 $\frac{3}{4}$	28 $\frac{1}{2}$	61 $\frac{1}{2}$	28 $\frac{3}{4}$	61 $\frac{1}{4}$
6	2.65	1.41	2.65	1.42	2.64	1.43	2.63	1.44
7	3.09	1.64	3.08	1.66	3.08	1.67	3.07	1.68
8	3.53	1.88	3.52	1.89	3.51	1.91	3.51	1.93
9	3.97	2.11	3.96	2.13	3.95	2.15	3.94	2.17
10	4.41	2.35	4.40	2.37	4.39	2.39	4.38	2.40
11	4.86	2.58	4.84	2.60	4.83	2.63	4.82	2.64
12	5.30	2.82	5.28	2.84	5.27	2.86	5.26	2.89
13	5.74	3.05	5.72	3.08	5.71	3.10	5.70	3.13
14	6.18	3.29	6.17	3.31	6.15	3.34	6.14	3.37
15	6.62	3.52	6.61	3.55	6.59	3.58	6.58	3.61
16	7.06	3.76	7.05	3.79	7.03	3.82	7.01	3.85
17	7.50	3.99	7.49	4.02	7.47	4.06	7.45	4.09
18	7.95	4.22	7.93	4.26	7.91	4.29	7.89	4.33
19	8.39	4.46	8.37	4.50	8.35	4.53	8.33	4.57
20	8.83	4.69	8.81	4.73	8.79	4.77	8.77	4.81
21	9.27	4.93	9.25	4.97	9.23	5.01	9.21	5.05
22	9.71	5.16	9.69	5.21	9.67	5.25	9.64	5.29
23	10.15	5.40	10.13	5.44	10.11	5.49	10.08	5.53
24	10.60	5.63	10.57	5.68	10.54	5.73	10.52	5.77
25	11.04	5.87	11.01	5.92	10.98	5.97	10.96	6.01
26	11.48	6.10	11.45	6.15	11.42	6.20	11.40	6.25
27	11.92	6.34	11.89	6.39	11.86	6.44	11.84	6.49
28	12.36	6.57	12.33	6.63	12.30	6.68	12.27	6.73
29	12.80	6.81	12.77	6.86	12.74	6.92	12.71	6.97
30	13.24	7.04	13.21	7.10	13.18	7.16	13.15	7.22
31	13.68	7.28	13.65	7.34	13.62	7.40	13.59	7.46
32	14.12	7.51	14.09	7.57	14.06	7.63	14.03	7.70
33	14.57	7.75	14.53	7.81	14.50	7.87	14.47	7.94
34	15.01	7.98	14.97	8.05	14.94	8.11	14.91	8.18
35	15.45	8.22	15.41	8.28	15.38	8.35	15.34	8.42
36	15.89	8.45	15.86	8.52	15.82	8.59	15.78	8.66
37	16.33	8.68	16.30	8.76	16.26	8.83	16.22	8.90
38	16.77	8.92	16.74	8.99	16.70	9.07	16.66	9.14
39	17.22	9.15	17.18	9.23	17.14	9.30	17.10	9.38
40	17.66	9.39	17.62	9.47	17.58	9.54	17.53	9.62
41	18.10	9.62	18.06	9.70	18.02	9.78	17.97	9.86
42	18.54	9.86	18.50	9.94	18.45	10.02	18.41	10.10
43	18.98	10.09	18.94	10.18	18.89	10.26	18.85	10.34
44	19.42	10.33	19.38	10.41	19.33	10.50	19.29	10.58
45	19.86	10.56	19.82	10.65	19.77	10.74	19.73	10.82
46	20.31	10.80	20.26	10.89	20.21	10.97	20.17	11.06
47	20.75	11.03	20.70	11.12	20.65	11.21	20.60	11.30
48	21.19	11.27	21.14	11.36	21.09	11.45	21.04	11.54
49	21.63	11.50	21.58	11.60	21.53	11.69	21.48	11.78
50	22.07	11.74	22.02	11.83	21.97	11.93	21.92	12.02

^{2p.} ch.	29	61	29 $\frac{1}{2}$	60 $\frac{1}{2}$	29 $\frac{1}{4}$	60 $\frac{1}{4}$	29 $\frac{3}{4}$	60 $\frac{3}{4}$
6	2.62	1.45	2.62	1.47	2.61	1.48	2.60	1.49
7	3.06	1.70	3.05	1.71	3.05	1.72	3.04	1.74
8	3.50	1.94	3.49	1.95	3.48	1.97	3.47	1.98
9	3.94	2.18	3.93	2.20	3.92	2.22	3.91	2.23
10	4.37	2.42	4.36	2.44	4.35	2.46	4.34	2.48
11	4.81	2.66	4.80	2.69	4.79	2.71	4.78	2.73
12	5.25	2.91	5.24	2.93	5.22	2.95	5.21	2.98
13	5.68	3.15	5.67	3.18	5.66	3.20	5.64	3.23
14	6.12	3.39	6.11	3.42	6.09	3.45	6.08	3.47
15	6.56	3.64	6.54	3.66	6.53	3.69	6.51	3.72
16	7.00	3.88	6.98	3.91	6.96	3.94	6.94	3.97
17	7.43	4.12	7.42	4.15	7.40	4.18	7.38	4.22
18	7.87	4.36	7.85	4.40	7.83	4.43	7.81	4.47
19	8.31	4.61	8.29	4.64	8.27	4.68	8.25	4.71
20	8.75	4.85	8.72	4.89	8.70	4.92	8.68	4.96
21	9.18	5.09	9.16	5.13	9.14	5.17	9.12	5.21
22	9.62	5.33	9.60	5.37	9.57	5.42	9.55	5.46
23	10.06	5.57	10.03	5.62	10.01	5.66	9.99	5.71
24	10.50	5.81	10.47	5.86	10.44	5.91	10.42	5.95
25	10.93	6.06	10.91	6.11	10.88	6.16	10.85	6.20
26	11.37	6.30	11.34	6.35	11.31	6.40	11.29	6.45
27	11.81	6.54	11.78	6.60	11.75	6.65	11.72	6.70
28	12.25	6.79	12.22	6.84	12.18	6.89	12.16	7.95
29	12.68	7.03	12.65	7.08	12.62	7.14	12.59	7.19
30	13.12	7.27	13.09	7.33	13.06	7.39	13.02	7.44
31	13.56	7.51	13.52	7.57	13.49	7.63	13.46	7.69
32	13.99	7.76	13.96	7.82	13.93	7.88	13.89	7.94
33	14.43	8.00	14.40	8.06	14.36	8.13	14.33	8.19
34	14.87	8.24	14.83	8.31	14.80	8.37	14.76	8.43
35	15.31	8.49	15.27	8.55	15.23	8.62	15.20	8.68
36	15.74	8.73	15.70	8.80	15.67	8.86	15.63	8.93
37	16.18	8.97	16.14	9.04	16.10	9.11	16.06	9.18
38	16.62	9.21	16.58	9.28	16.54	9.36	16.50	9.43
39	17.05	9.45	17.01	9.53	16.97	9.60	16.93	9.67
40	17.49	9.70	17.45	9.77	17.41	9.85	17.36	9.92
41	17.93	9.94	17.89	10.02	17.84	10.09	17.80	10.17
42	18.37	10.18	18.32	10.26	18.28	10.34	18.23	10.42
43	18.80	10.42	18.76	10.51	18.71	10.59	18.67	10.67
44	19.24	10.66	19.20	10.75	19.15	10.83	19.10	10.92
45	19.68	10.91	19.63	10.99	19.58	11.08	19.54	11.16
46	20.12	11.15	20.07	11.24	20.02	11.33	19.97	11.41
47	20.55	11.39	20.50	11.48	20.45	11.57	20.41	11.66
48	20.99	11.64	20.94	11.73	20.89	11.82	20.84	11.91
49	21.43	11.88	21.38	11.97	21.32	12.06	21.27	12.16
50	21.87	12.12	21.81	12.22	21.76	12.31	21.70	12.40

2 ^d . ch.	30	60	30 $\frac{1}{2}$	59 $\frac{1}{2}$	30 $\frac{1}{2}$	59 $\frac{1}{2}$	30 $\frac{1}{2}$	59 $\frac{1}{2}$
6	2.60	1.50	2.59	1.51	2.58	1.52	2.58	1.53
7	3.03	1.75	3.02	1.76	3.01	1.78	3.01	1.79
8	3.46	2.00	3.46	2.01	3.45	2.03	3.44	2.04
9	3.90	2.25	3.89	2.27	3.88	2.28	3.87	2.30
10	4.33	2.50	4.32	2.52	4.31	2.54	4.30	2.56
11	4.76	2.75	4.75	2.77	4.74	2.79	4.73	2.81
12	5.20	3.00	5.18	3.02	5.17	3.04	5.16	3.07
13	5.63	3.25	5.61	3.27	5.60	3.30	5.59	3.32
14	6.06	3.50	6.05	3.53	6.03	3.55	6.01	3.58
15	6.50	3.75	6.48	3.78	6.46	3.81	6.44	3.84
16	6.93	4.00	6.91	4.03	6.89	4.06	6.88	4.09
17	7.36	4.25	7.34	4.28	7.32	4.31	7.30	4.35
18	7.79	4.50	7.77	4.53	7.75	4.57	7.73	4.60
19	8.23	4.75	8.21	4.78	8.18	4.82	8.16	4.86
20	8.66	5.00	8.64	5.04	8.62	5.08	8.59	5.11
21	9.09	5.25	9.07	5.29	9.05	5.33	9.02	5.37
22	9.53	5.50	9.50	5.54	9.48	5.58	9.45	5.63
23	9.96	5.75	9.93	5.79	9.91	5.84	9.88	5.88
24	10.39	6.00	10.37	6.04	10.34	6.09	10.31	6.14
25	10.83	6.25	10.80	6.30	10.77	6.34	10.74	6.39
26	11.26	6.50	11.23	6.55	11.20	6.60	11.17	6.65
27	11.69	6.75	11.66	6.80	11.63	6.85	11.60	6.90
28	12.13	7.00	12.09	7.05	12.06	7.10	12.03	7.16
29	12.56	7.25	12.53	7.30	12.49	7.36	12.46	7.41
30	12.99	7.50	12.96	7.56	12.92	7.61	12.89	7.67
31	13.42	7.75	13.39	7.81	13.35	7.87	13.32	7.92
32	13.86	8.00	13.82	8.06	13.78	8.12	13.75	8.18
33	14.29	8.25	14.25	8.31	14.21	8.37	14.18	8.44
34	14.72	8.50	14.69	8.56	14.64	8.63	14.61	8.69
35	15.15	8.75	15.12	8.81	15.07	8.88	15.04	8.95
36	15.59	9.00	15.55	9.07	15.51	9.13	15.47	9.20
37	16.02	9.25	15.98	9.32	15.94	9.39	15.90	9.46
38	16.45	9.50	16.41	9.57	16.37	9.64	16.33	9.71
39	16.89	9.75	16.84	9.82	16.80	9.90	16.76	9.97
40	17.32	10.00	17.28	10.07	17.23	10.15	17.19	10.23
41	17.75	10.25	17.71	10.33	17.66	10.40	17.62	10.48
42	18.19	10.50	18.14	10.58	18.09	10.66	18.05	10.74
43	18.62	10.75	18.57	10.83	18.52	10.91	18.48	10.99
44	19.05	11.00	19.00	11.08	18.96	11.16	18.91	11.25
45	19.48	11.25	19.44	11.33	19.39	11.42	19.34	11.51
46	19.92	11.50	19.87	11.59	19.82	11.67	19.77	11.76
47	20.35	11.75	20.30	11.84	20.25	11.93	20.20	12.02
48	20.78	12.00	20.73	12.09	20.68	12.18	20.63	12.27
49	21.22	12.25	21.16	12.34	21.11	12.43	21.06	12.53
50	21.65	12.50	21.60	12.59	21.54	12.69	21.49	12.78

ap. ch.	31	59	31½	58½	31½	58½	31½	58½
6	2.57	1.55	2.56	1.56	2.56	1.57	2.55	1.58
7	3.00	1.80	2.99	1.82	2.98	1.83	2.98	1.84
8	3.43	2.06	3.42	2.07	3.41	2.09	3.40	2.10
9	3.86	2.32	3.85	2.33	3.84	2.35	3.83	2.37
10	4.29	2.57	4.27	2.59	4.26	2.61	4.25	2.63
11	4.71	2.83	4.70	2.85	4.69	2.87	4.68	2.89
12	5.14	3.09	5.13	3.11	5.11	3.14	5.10	3.16
13	5.57	3.35	5.56	3.37	5.54	3.40	5.53	3.42
14	6.00	3.60	5.98	3.63	5.97	3.66	5.95	3.68
15	6.43	3.86	6.41	3.89	6.39	3.92	6.38	3.95
16	6.86	4.12	6.84	4.15	6.82	4.18	6.80	4.21
17	7.29	4.38	7.27	4.41	7.25	4.44	7.23	4.47
18	7.71	4.64	7.69	4.67	7.67	4.70	7.65	4.74
19	8.14	4.89	8.12	4.93	8.10	4.96	8.08	5.00
20	8.57	5.15	8.55	5.19	8.53	5.22	8.50	5.26
21	9.00	5.41	8.98	5.45	8.95	5.49	8.93	5.53
22	9.43	5.67	9.40	5.71	9.38	5.75	9.35	5.79
23	9.86	5.92	9.83	5.97	9.81	6.01	9.78	6.05
24	10.29	6.18	10.26	6.23	10.23	6.27	10.20	6.31
25	10.71	6.44	10.69	6.48	10.66	6.53	10.63	6.58
26	11.14	6.70	11.11	6.74	11.09	6.79	11.05	6.84
27	11.57	6.95	11.54	7.00	11.51	7.05	11.48	7.10
28	12.00	7.21	11.97	7.26	11.94	7.31	11.90	7.37
29	12.43	7.47	12.40	7.52	12.37	7.58	12.33	7.63
30	12.86	7.72	12.82	7.78	12.79	7.84	12.76	7.89
31	13.29	7.98	13.25	8.04	13.22	8.10	13.18	8.16
32	13.71	8.24	13.68	8.30	13.64	8.36	13.61	8.42
33	14.14	8.50	14.11	8.56	14.07	8.62	14.03	8.68
34	14.57	8.76	14.53	8.82	14.50	8.88	14.46	8.95
35	15.00	9.01	14.96	9.08	14.92	9.14	14.88	9.21
36	15.43	9.27	15.39	9.34	15.35	9.40	15.31	9.47
37	15.86	9.53	15.82	9.60	15.77	9.67	15.73	9.73
38	16.29	9.79	16.24	9.86	16.20	9.93	16.16	10.00
39	16.71	10.04	16.67	10.12	16.63	10.19	16.58	10.26
40	17.14	10.30	17.10	10.37	17.05	10.45	17.01	10.52
41	17.57	10.56	17.53	10.63	17.48	10.71	17.43	10.79
42	18.00	10.82	17.95	10.89	17.91	10.97	17.86	11.05
43	18.43	11.07	18.38	11.15	18.33	11.23	18.28	11.31
44	18.86	11.33	18.81	11.41	18.76	11.49	18.70	11.57
45	19.29	11.59	19.24	11.67	19.18	11.76	19.13	11.84
46	19.71	11.85	19.66	11.93	19.61	12.02	19.56	12.10
47	20.14	12.10	20.09	12.19	20.03	12.28	19.98	12.36
48	20.57	12.36	20.52	12.45	20.46	12.54	20.41	12.63
49	21.00	12.62	20.95	12.71	20.89	12.80	20.83	12.89
50	21.43	12.87	21.37	12.97	21.31	13.06	21.26	13.15

² p. ch.	32	58	32 $\frac{1}{4}$	57 $\frac{1}{4}$	32 $\frac{1}{2}$	57 $\frac{1}{2}$	32 $\frac{3}{4}$	57 $\frac{3}{4}$
6	2.54	1.59	2.54	1.60	2.53	1.61	2.52	1.62
7	2.97	1.85	2.96	1.87	2.95	1.88	2.94	1.89
8	3.39	2.12	3.38	2.13	3.37	2.15	3.36	2.16
9	3.82	2.38	3.81	2.40	3.79	2.42	3.78	2.43
10	4.24	2.65	4.23	2.67	4.22	2.69	4.21	2.70
11	4.66	2.91	4.65	2.94	4.64	2.95	4.63	2.97
12	5.09	3.18	5.07	3.20	5.06	3.22	5.05	3.24
13	5.51	3.44	5.50	3.47	5.48	3.49	5.47	3.51
14	5.94	3.71	5.92	3.74	5.90	3.76	5.89	3.79
15	6.36	3.97	6.34	4.00	6.33	4.03	6.31	4.06
16	6.78	4.24	6.76	4.27	6.75	4.30	6.73	4.32
17	7.21	4.50	7.19	4.53	7.17	4.57	7.15	4.59
18	7.63	4.77	7.61	4.80	7.59	4.84	7.57	4.87
19	8.06	5.02	8.03	5.07	8.01	5.10	7.99	5.14
20	8.48	5.30	8.46	5.34	8.43	5.37	8.41	5.41
21	8.90	5.57	8.88	5.60	8.86	5.64	8.83	5.68
22	9.33	5.83	9.30	5.87	9.28	5.91	9.25	5.95
23	9.75	6.10	9.73	6.14	9.70	6.18	9.67	6.22
24	10.18	6.36	10.15	6.40	10.12	6.45	10.09	6.49
25	10.60	6.62	10.57	6.67	10.54	6.72	10.51	6.76
26	11.02	6.89	11.00	6.94	10.96	6.99	10.93	7.03
27	11.45	7.15	11.42	7.20	11.38	7.25	11.35	7.30
28	11.87	7.42	11.84	7.47	11.81	7.52	11.77	7.57
29	12.30	7.68	12.27	7.74	12.23	7.79	12.19	7.84
30	12.72	7.95	12.69	8.00	12.65	8.06	12.62	8.11
31	13.14	8.21	13.11	8.27	13.07	8.33	13.04	8.38
32	13.57	8.48	13.53	8.54	13.49	8.60	13.46	8.65
33	13.99	8.74	13.96	8.80	13.92	8.86	13.88	8.92
34	14.42	9.01	14.38	9.07	14.34	9.13	14.30	9.20
35	14.84	9.27	14.80	9.34	14.76	9.40	14.72	9.47
36	15.26	9.54	15.22	9.60	15.18	9.67	15.14	9.74
37	15.69	9.80	15.64	9.87	15.60	9.94	15.56	10.01
38	16.11	10.07	16.07	10.14	16.02	10.21	15.98	10.28
39	16.54	10.33	16.49	10.41	16.45	10.48	16.40	10.55
40	16.96	10.60	16.91	10.67	16.87	10.75	16.82	10.82
41	17.39	10.86	17.34	10.94	17.29	11.01	17.24	11.09
42	17.81	11.13	17.76	11.21	17.71	11.28	17.66	11.36
43	18.23	11.39	18.18	11.47	18.13	11.55	18.08	11.63
44	18.66	11.66	18.60	11.74	18.55	11.82	18.50	11.90
45	19.08	11.92	19.03	12.01	18.98	12.09	18.92	12.17
46	19.50	12.19	19.45	12.27	19.40	12.36	19.34	12.44
47	19.93	12.45	19.87	12.44	19.82	12.63	19.76	12.71
48	20.35	12.72	20.30	12.81	20.24	12.90	20.18	12.98
49	20.78	12.98	20.72	13.07	20.66	13.16	20.60	13.25
50	21.20	13.25	21.14	13.34	21.08	13.43	21.03	13.52

² p. ch.	33	57	33 $\frac{1}{4}$	56 $\frac{1}{4}$	33 $\frac{1}{2}$	56 $\frac{1}{2}$	33 $\frac{3}{4}$	56 $\frac{3}{4}$
6	2.52	1.63	2.51	1.64	2.50	1.66	2.49	1.67
7	2.94	1.90	2.93	1.92	2.92	1.93	2.91	1.94
8	3.35	2.18	3.35	2.19	3.33	2.21	3.33	2.22
9	3.77	2.45	3.76	2.47	3.75	2.48	3.74	2.50
10	4.19	2.72	4.18	2.74	4.17	2.76	4.16	2.78
11	4.61	3.00	4.60	3.02	4.59	3.03	4.57	3.06
12	5.03	3.27	5.02	3.29	5.00	3.31	4.99	3.33
13	5.45	3.54	5.44	3.56	5.42	3.59	5.40	3.61
14	5.87	3.81	5.85	3.84	5.84	3.86	5.82	3.89
15	6.29	4.08	6.27	4.11	6.25	4.14	6.24	4.17
16	6.71	4.36	6.69	4.39	6.67	4.42	6.65	4.44
17	7.13	4.63	7.11	4.66	7.09	4.89	7.07	4.72
18	7.55	4.90	7.53	4.93	7.50	4.97	7.48	5.00
19	7.97	5.17	7.94	5.21	7.92	5.24	7.90	5.28
20	8.39	5.45	8.36	5.48	8.34	5.52	8.31	5.56
21	8.81	5.72	8.78	5.76	8.76	5.79	8.73	5.83
22	9.22	5.99	9.20	6.03	9.17	6.07	9.15	6.11
23	9.64	6.26	9.62	6.31	9.59	6.35	9.56	6.39
24	10.06	6.54	10.03	6.58	10.01	6.62	9.98	6.67
25	10.48	6.81	10.45	6.85	10.42	6.90	10.39	6.94
26	10.90	7.08	10.87	7.13	10.84	7.18	10.81	7.22
27	11.32	7.35	11.29	7.40	11.26	7.45	11.23	7.50
28	11.74	7.62	11.71	7.68	11.67	7.73	11.64	7.78
29	12.16	7.90	12.13	7.95	12.09	8.00	12.06	8.06
30	12.58	8.17	12.54	8.22	12.51	8.28	12.47	8.33
31	13.00	8.44	12.96	8.50	12.92	8.56	12.89	8.61
32	13.42	8.71	13.38	8.77	13.34	8.83	13.30	8.89
33	13.84	8.99	13.80	9.05	13.76	9.11	13.72	9.17
34	14.26	9.26	14.22	9.32	14.17	9.39	14.14	9.44
35	14.68	9.53	14.63	9.60	14.59	9.66	14.55	9.72
36	15.10	9.80	15.05	9.87	15.01	9.93	14.97	10.00
37	15.52	10.08	15.47	10.14	15.43	10.21	15.38	10.28
38	15.93	10.35	15.89	10.42	15.84	10.49	15.80	10.56
39	16.35	10.62	16.31	10.69	16.26	10.76	16.21	10.83
40	16.77	10.89	16.73	10.97	16.68	11.04	16.63	11.11
41	17.19	11.17	17.14	11.24	17.09	11.32	17.04	11.39
42	17.61	11.44	17.56	11.51	17.51	11.59	17.46	11.67
43	18.03	11.71	17.98	11.79	17.93	11.87	17.88	11.94
44	18.45	11.98	18.40	12.06	18.35	12.14	18.29	12.22
45	18.87	12.25	18.82	12.33	18.76	12.42	18.71	12.50
46	19.29	12.53	19.23	12.61	19.18	12.69	19.12	12.78
47	19.71	12.80	19.65	12.89	19.60	12.97	19.54	13.06
48	20.13	13.07	20.07	13.16	20.01	13.25	19.96	13.33
49	20.55	13.34	20.49	13.43	20.43	13.52	20.37	13.61
50	20.97	13.62	20.91	13.71	20.85	13.80	20.79	13.89

Tables of Right-Angled Triangles, &c.

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² p. ch.	34	56	34 ¹ / ₂	55 ¹ / ₂	34 ² / ₃	55 ² / ₃	34 ¹ / ₃	55 ¹ / ₃
6	2.49	1.68	2.48	1.69	2.47	1.70	2.46	1.71
7	2.90	1.96	2.89	1.97	2.88	1.98	2.87	2.00
8	3.32	2.24	3.31	2.25	3.30	2.26	3.29	2.28
9	3.73	2.52	3.72	2.53	3.71	2.55	3.70	2.56
10	4.14	2.80	4.13	2.81	4.12	2.83	4.11	2.85
11	4.56	3.08	4.54	3.09	4.53	3.12	4.52	3.13
12	4.97	3.36	4.96	3.38	4.94	3.40	4.93	3.42
13	5.39	3.63	5.37	3.66	5.36	3.68	5.34	3.71
14	5.80	3.91	5.79	3.94	5.77	3.96	5.75	3.99
15	6.22	4.19	6.20	4.22	6.18	4.25	6.16	4.28
16	6.63	4.47	6.61	4.50	6.59	4.53	6.57	4.56
17	7.05	4.75	7.03	4.78	7.00	4.81	6.98	4.85
18	7.46	5.03	7.44	5.06	7.42	5.10	7.39	5.13
19	7.88	5.31	7.85	5.34	7.83	5.38	7.80	5.42
20	8.29	5.59	8.27	5.63	8.24	5.66	8.22	5.70
21	8.70	5.87	8.68	5.91	8.65	5.95	8.63	5.98
22	9.12	6.15	9.09	6.19	9.06	6.23	9.04	6.27
23	9.53	6.43	9.51	6.47	9.48	6.51	9.45	6.55
24	9.95	6.71	9.92	6.75	9.89	6.80	9.86	6.84
25	10.36	6.99	10.33	7.03	10.30	7.08	10.27	7.12
26	10.78	7.27	10.75	7.31	10.71	7.36	10.68	7.41
27	11.19	7.55	11.16	7.60	11.13	7.65	11.09	7.70
28	11.61	7.83	11.57	7.88	11.54	7.93	11.50	7.98
29	12.02	8.11	11.99	8.16	11.95	8.21	11.91	8.27
30	12.43	8.39	12.40	8.44	12.36	8.50	12.32	8.55
31	12.85	8.67	12.81	8.72	12.77	8.78	12.73	8.84
32	13.26	8.95	13.23	9.00	13.19	9.06	13.14	9.12
33	13.68	9.23	13.64	9.28	13.60	9.35	13.56	9.40
34	14.09	9.51	14.05	9.57	14.01	9.63	13.97	9.69
35	14.51	9.78	14.46	9.85	14.42	9.91	14.38	9.98
36	14.92	10.07	14.88	10.13	14.83	10.20	14.79	10.26
37	15.34	10.34	15.29	10.41	15.25	10.48	15.20	10.54
38	15.75	10.62	15.70	10.69	15.66	10.76	15.61	10.83
39	16.17	10.90	16.12	10.97	16.07	11.05	16.02	11.12
40	16.58	11.18	16.53	11.26	16.48	11.33	16.43	11.40
41	17.00	11.46	16.95	11.54	16.89	11.61	16.84	11.69
42	17.41	11.74	17.36	11.82	17.31	11.89	17.25	11.97
43	17.82	12.02	17.77	12.10	17.72	12.17	17.66	12.26
44	18.24	12.30	18.18	12.38	18.13	12.46	18.08	12.54
45	18.65	12.58	18.60	12.66	18.54	12.74	18.49	12.82
46	19.07	12.86	19.01	12.94	18.95	13.02	18.90	13.11
47	19.48	13.14	19.43	13.22	19.37	13.30	19.31	13.39
48	19.90	13.42	19.84	13.51	19.78	13.59	19.72	13.68
49	20.31	13.70	20.25	13.79	20.19	13.87	20.13	13.96
50	20.72	13.98	20.66	14.07	20.60	14.16	20.54	14.25

^{2p.} ch.	35	55	35 $\frac{1}{2}$	54 $\frac{1}{2}$	35 $\frac{1}{2}$	54 $\frac{1}{2}$	35 $\frac{1}{2}$	54 $\frac{1}{2}$
6	2.46	1.72	2.45	1.73	2.44	1.74	2.43	1.75
7	2.87	2.01	2.86	2.02	2.85	2.03	2.84	2.04
8	3.28	2.29	3.27	2.31	3.26	2.32	3.25	2.34
9	3.69	2.58	3.67	2.60	3.66	2.61	3.65	2.63
10	4.09	2.87	4.08	2.89	4.07	2.90	4.06	2.92
11	4.50	3.15	4.49	3.17	4.48	3.19	4.46	3.21
12	4.91	3.44	4.90	3.46	4.88	3.48	4.87	3.50
13	5.32	3.73	5.31	3.75	5.29	3.77	5.28	3.80
14	5.73	4.02	5.72	4.04	5.70	4.06	5.68	4.09
15	6.14	4.30	6.13	4.33	6.11	4.35	6.09	4.38
16	6.55	4.59	6.53	4.62	6.51	4.65	6.49	4.67
17	6.96	4.88	6.94	4.91	6.92	4.94	6.90	4.97
18	7.37	5.16	7.35	5.19	7.33	5.23	7.30	5.26
19	7.78	5.45	7.76	5.48	7.73	5.52	7.71	5.55
20	8.19	5.74	8.17	5.77	8.14	5.81	8.12	5.84
21	8.60	6.02	8.57	6.06	8.55	6.10	8.52	6.13
22	9.01	6.31	8.98	6.35	8.96	6.39	8.93	6.43
23	9.42	6.60	9.39	6.64	9.36	6.68	9.33	6.72
24	9.83	6.88	9.80	6.93	9.77	6.97	9.74	7.01
25	10.24	7.17	10.21	7.21	10.18	7.26	10.14	7.30
26	10.65	7.46	10.62	7.50	10.58	7.55	10.55	7.59
27	11.06	7.74	11.02	7.79	10.99	7.84	10.96	7.89
28	11.47	8.03	11.43	8.08	11.40	8.13	11.36	8.18
29	11.88	8.31	11.84	8.37	11.80	8.42	11.77	8.47
30	12.29	8.60	12.25	8.66	12.21	8.71	12.17	8.76
31	12.70	8.89	12.66	8.94	12.62	9.00	12.58	9.05
32	13.11	9.18	13.07	9.23	13.03	9.29	12.98	9.35
33	13.52	9.46	13.47	9.52	13.43	9.58	13.39	9.64
34	13.93	9.75	13.88	9.81	13.84	9.87	13.80	9.93
35	14.34	10.04	14.29	10.10	14.25	10.16	14.20	10.22
36	14.75	10.32	14.70	10.39	14.65	10.45	14.61	10.52
37	15.15	10.61	15.11	10.68	15.06	10.74	15.01	10.81
38	15.56	10.90	15.52	10.96	15.47	11.03	15.42	11.10
39	15.97	11.19	15.92	11.25	15.87	11.32	15.83	11.39
40	16.38	11.47	16.33	11.54	16.28	11.61	16.23	11.69
41	16.79	11.76	16.74	11.83	16.69	11.90	16.64	11.98
42	17.20	12.05	17.15	12.12	17.10	12.19	17.04	12.27
43	17.61	12.33	17.56	12.41	17.50	12.48	17.45	12.56
44	18.02	12.62	17.97	12.70	17.91	12.77	17.85	12.85
45	18.43	12.91	18.37	12.98	18.32	13.06	18.26	13.14
46	18.84	13.19	18.78	13.27	18.72	13.36	18.66	13.44
47	19.25	13.48	19.19	13.56	19.13	13.65	19.07	13.73
48	19.66	13.77	19.60	13.85	19.54	13.94	19.48	14.02
49	20.07	14.05	20.01	14.14	19.95	14.23	19.88	14.31
50	20.48	14.34	20.42	14.43	20.35	14.52	20.29	14.61

² P. ch.	36	54	36 $\frac{1}{2}$	53 $\frac{1}{2}$	36 $\frac{1}{2}$	53 $\frac{1}{2}$	36 $\frac{1}{2}$	53 $\frac{1}{2}$
6	2.43	1.76	2.42	1.77	2.41	1.78	2.40	1.80
7	2.83	2.06	2.82	2.07	2.81	2.08	2.80	2.09
8	3.24	2.35	3.23	2.36	3.21	2.38	3.21	2.39
9	3.64	2.65	3.63	2.66	3.62	2.68	3.61	2.69
10	4.04	2.94	4.03	2.96	4.02	2.97	4.01	2.99
11	4.45	3.23	4.43	3.25	4.42	3.27	4.41	3.29
12	4.85	3.53	4.84	3.55	4.82	3.57	4.81	3.59
13	5.26	3.82	5.24	3.84	5.22	3.86	5.21	3.89
14	5.66	4.11	5.64	4.14	5.63	4.16	5.61	4.19
15	6.07	4.41	6.05	4.43	6.03	4.46	6.01	4.49
16	6.47	4.70	6.45	4.73	6.43	4.76	6.41	4.79
17	6.88	5.00	6.85	5.03	6.83	5.05	6.81	5.09
18	7.28	5.29	7.26	5.32	7.23	5.35	7.21	5.38
19	7.69	5.58	7.66	5.62	7.64	5.65	7.61	5.68
20	8.09	5.88	8.06	5.91	8.04	5.95	8.01	5.98
21	8.49	6.17	8.47	6.21	8.44	6.25	8.41	6.28
22	8.90	6.47	8.87	6.51	8.84	6.54	8.81	6.58
23	9.30	6.76	9.28	6.80	9.24	6.84	9.21	6.88
24	9.71	7.05	9.68	7.09	9.65	7.14	9.62	7.18
25	10.11	7.35	10.08	7.39	10.05	7.43	10.02	7.48
26	10.52	7.64	10.48	7.69	10.45	7.73	10.42	7.78
27	10.92	7.94	10.89	7.98	10.85	8.03	10.82	8.08
28	11.32	8.23	11.29	8.28	11.25	8.33	11.22	8.38
29	11.73	8.52	11.69	8.58	11.66	8.62	11.62	8.67
30	12.14	8.82	12.10	8.87	12.06	8.92	12.02	8.97
31	12.54	9.11	12.50	9.16	12.46	9.22	12.42	9.27
32	12.94	9.41	12.90	9.46	12.86	9.52	12.82	9.57
33	13.35	9.70	13.31	9.76	13.26	9.81	13.22	9.87
34	13.75	9.99	13.71	10.05	13.67	10.11	13.62	10.17
35	14.16	10.29	14.11	10.35	14.07	10.41	14.02	10.47
36	14.56	10.58	14.52	10.64	14.47	10.71	14.42	10.77
37	14.97	10.87	14.92	10.94	14.87	11.00	14.82	11.07
38	15.37	11.17	15.32	11.23	15.27	11.30	15.22	11.37
39	15.77	11.46	15.73	11.53	15.67	11.60	15.62	11.67
40	16.18	11.76	16.13	11.83	16.08	11.90	16.02	11.97
41	16.58	12.05	16.53	12.12	16.48	12.19	16.42	12.27
42	16.99	12.34	16.93	12.42	16.88	12.49	16.83	12.56
43	17.39	12.64	17.34	12.71	17.28	12.79	17.23	12.86
44	17.80	12.93	17.74	13.01	17.68	13.09	17.63	13.16
45	18.20	13.23	18.15	13.30	18.09	13.38	18.03	13.46
46	18.61	13.52	18.55	13.60	18.49	13.68	18.43	13.76
47	19.01	13.81	18.95	13.90	18.89	13.98	18.83	14.06
48	19.42	14.11	19.35	14.19	19.29	14.28	19.23	14.36
49	19.82	14.40	19.76	14.49	19.69	14.57	19.63	14.66
50	20.23	14.70	20.16	14.78	20.10	14.87	20.03	14.96

² p. ch.	37	53	37 $\frac{1}{2}$	52 $\frac{1}{2}$	37 $\frac{1}{4}$	52 $\frac{1}{4}$	37 $\frac{3}{4}$	52 $\frac{3}{4}$
6	2.40	1.80	2.39	1.81	2.38	1.83	2.37	1.84
7	2.79	2.11	2.79	2.12	2.78	2.13	3.77	2.14
8	3.19	2.41	3.18	2.42	3.17	2.44	3.16	2.45
9	3.59	2.71	3.58	2.72	3.57	2.74	3.56	2.75
10	3.99	3.01	3.98	3.03	3.97	3.04	3.95	3.06
11	4.39	3.31	4.38	3.33	4.36	3.35	4.35	3.37
12	4.79	3.61	4.78	3.63	4.76	3.65	4.74	3.67
13	5.19	3.91	5.17	3.93	5.16	3.96	5.14	3.98
14	5.59	4.21	5.57	4.24	5.55	4.26	5.53	4.29
15	5.99	4.51	5.97	4.54	5.95	4.57	5.93	4.59
16	6.39	4.81	6.37	4.84	6.35	4.87	6.32	4.90
17	6.79	5.11	6.77	5.14	6.74	5.17	6.72	5.20
18	7.19	5.42	7.16	5.45	7.14	5.48	7.12	5.51
19	7.59	5.72	7.56	5.75	7.54	5.78	7.51	5.82
20	7.99	6.02	7.96	6.05	7.93	6.09	7.91	6.12
21	8.39	6.32	8.36	6.36	8.33	6.39	8.30	6.43
22	8.79	6.62	8.76	6.66	8.73	6.69	8.70	6.73
23	9.18	6.92	9.15	6.96	9.12	7.00	9.09	7.04
24	9.58	7.22	9.55	7.26	9.52	7.31	9.49	7.35
25	9.98	7.52	9.95	7.57	9.92	7.61	9.88	7.65
26	10.38	7.82	10.35	7.87	10.31	7.91	10.28	7.96
27	10.78	8.12	10.75	8.17	10.71	8.22	10.67	8.26
28	11.18	8.42	11.14	8.47	11.11	8.52	11.07	8.57
29	11.58	8.73	11.54	8.78	11.50	8.83	11.46	8.87
30	11.98	9.03	11.94	9.08	11.90	9.13	11.86	9.18
31	12.38	9.33	12.34	9.38	12.30	9.43	12.26	9.49
32	12.78	9.63	12.74	9.68	12.69	9.74	12.65	9.80
33	13.18	9.93	13.13	9.99	13.09	10.04	13.05	10.10
34	13.58	10.23	13.53	10.29	13.49	10.35	13.44	10.41
35	13.98	10.53	13.93	10.59	13.88	10.65	13.84	10.71
36	14.38	10.83	14.33	10.90	14.28	10.96	14.23	11.02
37	14.77	11.13	14.73	11.20	14.68	11.26	14.63	11.32
38	15.17	11.43	15.12	11.50	15.07	11.57	15.02	11.63
39	15.57	11.74	15.52	11.80	15.47	11.87	15.42	11.94
40	15.97	12.04	15.92	12.11	15.87	12.17	15.81	12.24
41	16.37	12.34	16.32	12.41	16.26	12.48	16.21	12.55
42	16.77	12.64	16.72	12.71	16.66	12.78	16.60	12.86
43	17.17	12.94	17.11	13.01	17.06	13.09	17.00	13.16
44	17.57	13.24	17.51	13.32	17.45	13.39	17.40	13.47
45	17.97	13.54	17.91	13.62	17.85	13.70	17.79	13.77
46	18.37	13.84	18.31	13.92	18.25	14.00	18.19	14.08
47	18.77	14.14	18.71	14.22	18.64	14.30	18.58	14.38
48	19.17	14.44	19.10	14.53	19.04	14.61	18.98	14.69
49	19.57	14.74	19.50	14.83	19.44	14.91	19.37	15.00
50	19.97	15.04	19.90	15.13	19.83	15.22	19.77	15.31

Tables of Right-Angled Triangles, &c.

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² p. ch.	38	52	38 $\frac{1}{2}$	51 $\frac{1}{2}$	38 $\frac{1}{2}$	51 $\frac{1}{2}$	38 $\frac{1}{2}$	51 $\frac{1}{2}$
6	2.36	1.85	2.34	1.86	2.35	1.87	2.34	1.88
7	2.76	2.15	2.75	2.17	2.74	2.18	2.73	2.19
8	3.15	2.46	3.14	2.48	3.13	2.49	3.12	2.50
9	3.55	2.77	3.53	2.79	3.52	2.80	3.51	2.82
10	3.94	3.08	3.93	3.09	3.91	3.11	3.90	3.13
11	4.33	3.39	4.32	3.40	4.30	3.42	4.29	3.44
12	4.73	3.69	4.71	3.71	4.70	3.73	4.68	3.75
13	5.12	4.00	5.10	4.02	5.09	4.04	5.07	4.07
14	5.52	4.31	5.50	4.33	5.48	4.36	5.46	4.38
15	5.91	4.62	5.89	4.64	5.87	4.67	5.85	4.69
16	6.30	4.93	6.28	4.95	6.26	4.98	6.24	5.01
17	6.70	5.23	6.68	5.26	6.65	5.29	6.63	5.32
18	7.09	5.54	7.07	5.57	7.04	5.60	7.02	5.63
19	7.49	5.85	7.46	5.88	7.43	5.91	7.41	5.95
20	7.88	6.16	7.85	6.19	7.83	6.22	7.80	6.26
21	8.27	6.46	8.25	6.50	8.22	6.54	8.19	6.57
22	8.67	6.77	8.64	6.81	8.61	6.85	8.58	6.89
23	9.06	7.08	9.03	7.12	9.00	7.16	8.97	7.20
24	9.46	7.39	9.42	7.43	9.39	7.47	9.36	7.51
25	9.85	7.70	9.82	7.74	9.78	7.78	9.75	7.82
26	10.24	8.00	10.21	8.05	10.17	8.09	10.14	8.14
27	10.64	8.31	10.60	8.36	10.56	8.40	10.53	8.45
28	11.03	8.62	11.00	8.67	10.96	8.71	10.92	8.76
29	11.43	8.93	11.39	8.98	11.35	9.03	11.31	9.08
30	11.82	9.24	11.78	9.29	11.74	9.34	11.70	9.39
31	12.21	9.54	12.17	9.60	12.13	9.65	12.09	9.70
32	12.61	9.85	12.57	9.90	12.52	9.96	12.48	10.01
33	13.00	10.16	12.96	10.21	12.91	10.27	12.87	10.33
34	13.40	10.47	13.35	10.52	13.30	10.58	13.26	10.64
35	13.79	10.77	13.74	10.83	13.70	10.89	13.65	10.95
36	14.18	11.08	14.14	11.14	14.09	11.20	14.04	11.27
37	14.58	11.39	14.53	11.45	14.48	11.51	14.43	11.58
38	14.97	11.70	14.92	11.76	14.87	11.83	14.82	11.89
39	15.37	12.00	15.31	12.07	15.26	12.14	15.21	12.20
40	15.76	12.31	15.71	12.38	15.65	12.45	15.60	12.52
41	16.15	12.62	16.10	12.69	16.04	12.76	15.99	12.83
42	16.55	12.93	16.49	13.00	16.43	13.07	16.38	13.14
43	16.94	13.24	16.88	13.31	16.82	13.38	16.77	13.46
44	17.34	13.54	17.28	13.62	17.22	13.70	17.16	13.77
45	17.73	13.85	17.67	13.93	17.61	14.01	17.55	14.08
46	18.12	14.16	18.06	14.24	18.00	14.32	17.94	14.39
47	18.52	14.47	18.46	14.55	18.39	14.63	18.33	14.71
48	18.91	14.78	18.85	14.86	18.78	14.94	18.72	15.02
49	19.31	15.08	19.24	15.17	19.17	15.25	19.11	15.33
50	19.70	15.39	19.63	15.48	19.56	15.56	19.50	15.65

^{2p.} _{ab.}	39	51	39 $\frac{1}{4}$	50 $\frac{1}{4}$	39 $\frac{1}{2}$	50 $\frac{1}{2}$	39 $\frac{3}{4}$	50 $\frac{3}{4}$
6	2.33	1.89	2.32	1.90	2.31	1.91	2.31	1.92
7	2.72	2.20	2.71	2.21	2.70	2.23	2.69	2.24
8	3.12	2.52	3.10	2.53	3.09	2.54	3.07	2.56
9	3.51	2.83	3.48	2.85	3.47	2.86	3.46	2.88
10	3.88	3.15	3.87	3.16	3.86	3.18	3.84	3.20
11	4.27	3.46	4.26	3.48	4.24	3.50	4.23	3.52
12	4.66	3.78	4.65	3.80	4.63	3.82	4.61	3.84
13	5.05	4.09	5.03	4.11	5.01	4.13	5.00	4.16
14	5.44	4.41	5.42	4.43	5.40	4.45	5.38	4.48
15	5.83	4.72	5.81	4.74	5.79	4.77	5.77	4.80
16	6.22	5.03	6.20	5.06	6.17	5.09	6.15	5.12
17	6.61	5.35	6.58	5.38	6.56	5.41	6.53	5.44
18	6.99	5.66	6.97	5.69	6.94	5.72	6.92	5.75
19	7.38	5.98	7.36	6.01	7.33	6.04	7.30	6.07
20	7.77	6.29	7.74	6.33	7.72	6.36	7.69	6.39
21	8.16	6.61	8.13	6.64	8.10	6.68	8.07	6.71
22	8.55	6.92	8.52	6.96	8.49	7.00	8.46	7.03
23	8.94	7.24	8.91	7.28	8.87	7.32	8.84	7.35
24	9.33	7.55	9.29	7.59	9.26	7.63	9.23	7.67
25	9.71	7.87	9.68	7.91	9.64	7.95	9.61	7.99
26	10.10	8.18	10.07	8.22	10.03	8.27	9.99	8.31
27	10.49	8.50	10.45	8.54	10.41	8.59	10.38	8.63
28	10.88	8.81	10.84	8.86	10.80	8.90	10.76	8.95
29	11.27	9.13	11.23	9.17	11.18	9.22	11.15	9.27
30	11.66	9.44	11.62	9.49	11.57	9.54	11.53	9.59
31	12.05	9.75	12.00	9.81	11.96	9.86	11.92	9.91
32	12.43	10.07	12.39	10.12	12.35	10.18	12.30	10.23
33	12.82	10.38	12.78	10.44	12.73	10.50	12.68	10.55
34	13.21	10.70	13.16	10.75	13.12	10.81	13.07	10.87
35	13.60	11.01	13.55	11.07	13.50	11.13	13.45	11.19
36	13.99	11.33	13.94	11.39	13.89	11.45	13.84	11.51
37	14.38	11.64	14.33	11.70	14.27	11.77	14.22	11.83
38	14.77	11.96	14.71	12.02	14.66	12.09	14.61	12.15
39	15.15	12.27	15.10	12.34	15.05	12.40	14.99	12.47
40	15.54	12.59	15.49	12.65	15.43	12.72	15.38	12.79
41	15.93	12.90	15.88	12.97	15.82	13.04	15.76	13.11
42	16.32	13.22	16.26	13.29	16.20	13.36	16.15	13.43
43	16.71	13.53	16.65	13.60	16.59	13.68	16.53	13.75
44	17.10	13.84	17.04	13.92	16.98	13.99	16.91	14.07
45	17.49	14.16	17.42	14.23	17.36	14.31	17.30	14.39
46	17.87	14.48	17.81	14.55	17.75	14.63	17.68	14.71
47	18.26	14.79	18.20	14.87	18.13	14.95	18.07	15.03
48	18.65	15.10	18.59	15.18	18.52	15.26	18.45	15.35
49	19.04	15.42	18.97	15.50	18.90	15.58	18.84	15.67
50	19.43	15.73	19.36	15.82	19.29	15.90	19.22	15.99

² p. ch.	40	50	40 $\frac{1}{2}$	49 $\frac{1}{2}$	40 $\frac{1}{2}$	49 $\frac{1}{2}$	40 $\frac{1}{2}$	49 $\frac{1}{2}$
6	2.30	1.93	2.29	1.94	2.28	1.95	2.27	1.96
7	2.68	2.25	2.67	2.26	2.66	2.27	2.65	2.28
8	3.06	2.57	3.05	2.58	3.04	2.60	3.03	2.61
9	3.45	2.89	3.43	2.91	3.42	2.92	3.41	2.94
10	3.83	3.21	3.82	3.23	3.80	3.25	3.79	3.26
11	4.21	3.53	4.20	3.55	4.18	3.57	4.17	3.59
12	4.60	3.86	4.58	3.88	4.56	3.90	4.54	3.92
13	4.98	4.18	4.96	4.20	4.94	4.22	4.92	4.24
14	5.36	4.50	5.34	4.52	5.32	4.55	5.30	4.57
15	5.75	4.82	5.72	4.85	5.70	4.87	5.68	4.90
16	6.13	5.14	6.10	5.17	6.08	5.20	6.06	5.22
17	6.51	5.46	6.49	5.49	6.46	5.52	6.44	5.55
18	6.89	5.78	6.87	5.81	6.84	5.85	6.82	5.87
19	7.28	6.11	7.25	6.14	7.22	6.17	7.20	6.20
20	7.66	6.43	7.63	6.46	7.60	6.49	7.57	6.53
21	8.04	6.75	8.01	6.78	7.98	6.82	7.95	6.85
22	8.43	7.07	8.39	7.11	8.36	7.14	8.33	7.18
23	8.81	7.39	8.78	7.43	8.74	7.47	8.71	7.51
24	9.19	7.71	9.16	7.75	9.12	7.79	9.09	7.83
25	9.58	8.03	9.54	8.08	9.50	8.12	9.47	8.16
26	9.96	8.35	9.92	8.40	9.88	8.44	9.85	8.48
27	10.34	8.68	10.30	8.72	10.27	8.77	10.23	8.81
28	10.72	9.00	10.68	9.05	10.65	9.09	10.61	9.14
29	11.11	9.32	11.07	9.37	11.03	9.42	10.98	9.46
30	11.49	9.64	11.45	9.69	11.41	9.74	11.36	9.79
31	11.87	9.96	11.83	10.02	11.79	10.07	11.74	10.12
32	12.26	10.28	12.21	10.34	12.17	10.39	12.12	10.44
33	12.64	10.60	12.59	10.66	12.55	10.72	12.50	10.77
34	13.02	10.93	12.97	10.99	12.93	11.04	12.88	11.10
35	13.41	11.25	13.36	11.31	13.31	11.36	13.26	11.42
36	13.79	11.57	13.74	11.63	13.69	11.69	13.64	11.75
37	14.17	11.89	14.12	11.95	14.07	12.01	14.02	12.08
38	14.55	12.21	14.50	12.28	14.45	12.34	14.39	12.40
39	14.94	12.53	14.88	12.60	14.83	12.66	14.77	12.73
40	15.32	12.86	15.27	12.92	15.21	12.99	15.15	13.06
41	15.70	13.18	15.65	13.24	15.59	13.31	15.53	13.38
42	16.09	13.50	16.03	13.57	15.97	13.64	15.91	13.71
43	16.47	13.82	16.41	13.89	16.35	13.96	16.29	14.03
44	16.85	14.14	16.79	14.21	16.73	14.28	16.67	14.36
45	17.23	14.46	17.17	14.54	17.11	14.61	17.05	14.69
46	17.61	14.78	17.55	14.86	17.49	14.94	17.42	15.01
47	18.00	15.11	17.94	15.18	17.87	15.26	17.80	15.34
48	18.38	15.43	18.32	15.51	18.25	15.58	18.18	15.67
49	18.77	15.75	18.70	15.83	18.63	15.91	18.56	15.99
50	19.15	16.07	19.08	16.15	19.01	16.24	18.94	16.32

² p. ch.	41	49	41 $\frac{1}{4}$	48 $\frac{3}{4}$	41 $\frac{1}{2}$	48 $\frac{1}{2}$	41 $\frac{3}{4}$	48 $\frac{1}{4}$
6	2.26	1.97	2.25	1.98	2.25	1.99	2.24	2.00
7	2.64	2.30	2.63	2.31	2.62	2.32	2.61	2.33
8	3.02	2.62	3.01	2.64	3.00	2.65	2.98	2.66
9	3.40	2.95	3.38	2.97	3.37	2.98	3.36	2.99
10	3.77	3.28	3.76	3.30	3.74	3.31	3.73	3.33
11	4.15	3.61	4.14	3.63	4.12	3.64	4.10	3.66
12	4.53	3.94	4.51	3.96	4.49	3.98	4.48	3.99
13	4.91	4.26	4.89	4.29	4.87	4.31	4.85	4.33
14	5.28	4.59	5.26	4.62	5.24	4.64	5.22	4.66
15	5.66	4.92	5.64	4.95	5.62	4.97	5.60	4.99
16	6.04	5.25	6.01	5.27	5.99	5.30	5.97	5.33
17	6.41	5.58	6.39	5.60	6.37	5.63	6.34	5.66
18	6.79	5.90	6.77	5.93	6.74	5.96	6.71	5.99
19	7.17	6.23	7.14	6.26	7.11	6.29	7.09	6.32
20	7.55	6.56	7.52	6.59	7.49	6.63	7.46	6.66
21	7.92	6.89	7.89	6.92	7.86	6.96	7.83	6.99
22	8.30	7.22	8.27	7.25	8.24	7.29	8.21	7.32
23	8.68	7.54	8.65	7.58	8.61	7.62	8.58	7.66
24	9.06	7.87	9.02	7.91	8.99	7.95	8.95	7.99
25	9.43	8.20	9.40	8.24	9.36	8.28	9.33	8.32
26	9.81	8.53	9.77	8.57	9.74	8.61	9.70	8.65
27	10.19	8.86	10.15	8.90	10.11	8.94	10.07	8.99
28	10.57	9.18	10.53	9.23	10.49	9.28	10.44	9.32
29	10.94	9.51	10.90	9.56	10.86	9.61	10.82	9.65
30	11.32	9.84	11.28	9.89	11.23	9.94	11.19	9.99
31	11.70	10.17	11.65	10.22	11.61	10.27	11.56	10.32
32	12.07	10.50	12.03	10.55	11.98	10.60	11.94	10.65
33	12.45	10.83	12.40	10.88	12.36	10.93	12.31	10.99
34	12.83	11.15	12.78	11.21	12.73	11.26	12.68	11.32
35	13.21	11.48	13.16	11.54	13.11	11.59	13.06	11.65
36	13.58	11.81	13.53	11.87	13.48	11.93	13.43	11.98
37	13.96	12.14	13.91	12.20	13.85	12.26	13.80	12.32
38	14.34	12.47	14.28	12.53	14.23	12.59	14.18	12.65
39	14.72	12.79	14.66	12.86	14.60	12.92	14.55	12.98
40	15.09	13.12	15.01	13.19	14.98	13.25	14.92	13.32
41	15.47	13.45	15.41	13.52	15.35	13.58	15.29	13.65
42	15.85	13.78	15.79	13.85	15.73	13.91	15.67	13.98
43	16.23	14.10	16.16	14.18	16.10	14.25	16.04	14.32
44	16.60	14.43	16.54	14.51	16.48	14.58	16.41	14.65
45	16.98	14.76	16.92	14.84	16.85	14.91	16.78	14.98
46	17.36	15.09	17.29	15.17	17.22	15.24	17.16	15.32
47	17.73	15.42	17.67	15.50	17.60	15.57	17.53	15.65
48	18.11	15.75	18.04	15.82	17.97	15.90	17.91	15.98
49	18.49	16.07	18.42	16.15	18.35	16.23	18.28	16.31
50	18.87	16.40	18.80	16.48	18.72	16.57	18.65	16.65

up. ch.	42	48	42½	47½	42½	47½	42½	47½
6	2.23	2.01	2.22	2.02	2.21	2.03	2.20	2.04
7	2.60	2.34	2.59	2.35	2.58	2.36	2.57	2.38
8	2.97	2.68	2.96	2.69	2.95	2.70	2.94	2.71
9	3.34	3.01	3.33	3.03	3.32	3.04	3.30	3.05
10	3.72	3.34	3.70	3.36	3.69	3.38	3.67	3.39
11	4.09	3.68	4.07	3.70	4.06	3.71	4.04	3.73
12	4.46	4.01	4.44	4.03	4.42	4.05	4.41	4.07
13	4.83	4.35	4.81	4.37	4.79	4.39	4.77	4.41
14	5.20	4.68	5.18	4.71	5.16	4.73	5.14	4.75
15	5.57	5.02	5.55	5.04	5.53	5.07	5.51	5.09
16	5.95	5.35	5.92	5.38	5.90	5.40	5.87	5.43
17	6.32	5.69	6.29	5.71	6.27	5.74	6.24	5.77
18	6.69	6.02	6.66	6.05	6.64	6.08	6.61	6.11
19	7.06	6.36	7.03	6.39	7.00	6.42	6.98	6.45
20	7.43	6.69	7.40	6.72	7.37	6.76	7.34	6.79
21	7.80	7.03	7.77	7.06	7.74	7.09	7.71	7.13
22	8.17	7.36	8.14	7.40	8.11	7.43	8.08	7.47
23	8.54	7.69	8.51	7.73	8.48	7.77	8.44	7.81
24	8.92	8.03	8.88	8.07	8.85	8.11	8.81	8.15
25	9.29	8.36	9.25	8.40	9.22	8.45	9.18	8.48
26	9.66	8.70	9.62	8.74	9.58	8.78	9.55	8.82
27	10.03	9.03	9.99	9.07	9.95	9.12	9.91	9.16
28	10.40	9.36	10.36	9.41	10.32	9.46	10.28	9.50
29	10.77	9.70	10.73	9.75	10.69	9.80	10.65	9.84
30	11.15	10.04	11.10	10.09	11.06	10.13	11.01	10.18
31	11.52	10.37	11.47	10.42	11.43	10.47	11.38	10.52
32	11.89	10.71	11.84	10.76	11.80	10.81	11.75	10.86
33	12.26	11.04	12.21	11.09	12.17	11.15	12.12	11.20
34	12.63	11.37	12.58	11.43	12.53	11.49	12.48	11.54
35	13.00	11.71	12.95	11.76	12.90	11.82	12.85	11.88
36	13.38	12.04	13.32	12.10	13.27	12.16	13.22	12.22
37	13.75	12.38	13.69	12.44	13.64	12.50	13.58	12.56
38	14.12	12.71	14.06	12.77	14.01	12.84	13.95	12.90
39	14.59	13.05	14.43	13.11	14.38	13.17	14.32	13.24
40	14.86	13.38	14.80	13.45	14.75	13.51	14.69	13.58
41	15.23	13.72	15.17	13.78	15.11	13.85	15.05	13.92
42	15.61	14.05	15.54	14.12	15.48	14.19	15.42	14.25
43	15.98	14.39	15.91	14.46	15.85	14.53	15.79	14.59
44	16.35	14.72	16.28	14.79	16.22	14.86	16.15	14.93
45	16.72	15.05	16.66	15.13	16.59	15.20	16.52	15.27
46	17.09	15.39	17.03	15.46	16.96	15.54	16.89	15.61
47	17.46	15.72	17.40	15.80	17.33	15.88	17.26	15.95
48	17.83	16.06	17.77	16.13	17.69	16.21	17.62	16.29
49	18.21	16.39	18.14	16.47	18.06	16.55	17.99	16.63
50	18.58	16.73	18.51	16.81	18.43	16.89	18.36	16.97

² p. ch.	43	47	43 $\frac{1}{2}$	46 $\frac{1}{2}$	43 $\frac{1}{2}$	46 $\frac{1}{2}$	43 $\frac{1}{2}$	46 $\frac{1}{2}$
6	2.19	2.05	2.18	2.06	2.18	2.06	2.17	2.07
7	2.56	2.39	2.55	2.40	2.54	2.41	2.53	2.42
8	2.92	2.73	2.91	2.74	2.90	2.75	2.89	2.77
9	3.29	3.07	3.28	3.08	3.26	3.10	3.25	3.11
10	3.66	3.41	3.64	3.43	3.63	3.44	3.61	3.46
11	4.02	3.75	4.01	3.77	3.99	3.79	3.97	3.80
12	4.39	4.09	4.37	4.11	4.35	4.13	4.33	4.15
13	4.75	4.43	4.73	4.45	4.71	4.47	4.69	4.50
14	5.12	4.77	5.10	4.80	5.08	4.82	5.06	4.84
15	5.49	5.11	5.46	5.14	5.44	5.16	5.42	5.18
16	5.85	5.46	5.83	5.48	5.80	5.51	5.78	5.53
17	6.22	5.80	6.19	5.82	6.17	5.85	6.14	5.88
18	6.58	6.14	6.55	6.17	6.53	6.19	6.50	6.22
19	6.95	6.48	6.92	6.51	6.89	6.54	6.86	6.57
20	7.31	6.82	7.28	6.85	7.25	6.88	7.22	6.92
21	7.68	7.16	7.65	7.19	7.62	7.23	7.58	7.26
22	8.05	7.50	8.01	7.54	7.98	7.57	7.95	7.61
23	8.41	7.84	8.38	7.88	8.34	7.92	8.31	7.95
24	8.78	8.18	8.74	8.22	8.70	8.26	8.67	8.30
25	9.14	8.53	9.10	8.57	9.07	8.60	9.03	8.64
26	9.51	8.87	9.47	8.91	9.43	8.95	9.39	8.99
27	9.87	9.21	9.83	9.25	9.79	9.29	9.75	9.34
28	10.24	9.55	10.20	9.59	10.16	9.64	10.11	9.68
29	10.61	9.89	10.56	9.94	10.52	9.98	10.47	10.03
30	10.97	10.23	10.92	10.28	10.88	10.33	10.84	10.37
31	11.34	10.57	11.29	10.62	11.24	10.67	11.20	10.72
32	11.70	10.91	11.65	10.96	11.60	11.01	11.56	11.06
33	12.07	11.25	12.02	11.30	11.97	11.36	11.92	11.41
34	12.43	11.59	12.38	11.65	12.33	11.70	12.28	11.76
35	12.80	11.93	12.75	11.99	12.69	12.04	12.64	12.10
36	13.16	12.28	13.11	12.33	13.06	12.39	13.00	12.45
37	13.53	12.62	13.47	12.68	13.42	12.73	13.36	12.79
38	13.90	12.96	13.84	13.02	13.78	13.08	13.72	13.14
39	14.26	13.30	14.20	13.36	14.14	13.42	14.08	13.49
40	14.63	13.64	14.57	13.70	14.51	13.77	14.45	13.83
41	14.99	13.98	14.93	14.05	14.87	14.11	14.81	14.18
42	15.36	14.32	15.29	14.39	15.23	14.46	15.17	14.52
43	15.72	14.66	15.66	14.73	15.59	14.80	15.53	14.87
44	16.09	15.00	16.02	15.07	15.96	15.14	15.89	15.21
45	16.46	15.34	16.39	15.42	16.32	15.49	16.25	15.56
46	16.82	15.69	16.75	15.76	16.68	15.83	16.61	15.91
47	17.19	16.03	17.12	16.10	17.04	16.18	16.97	16.25
48	17.55	16.37	17.48	16.44	17.41	16.52	17.34	16.60
49	17.92	16.71	17.84	16.79	17.77	16.86	17.70	16.94
50	18.28	17.05	18.21	17.13	18.13	17.21	18.06	17.29

² p. ch.	44	46	44 ¹	45 ¹	44 ¹	45 ¹	44 ¹	45 ¹
6	2.16	2.08	2.15	2.09	2.14	2.10	2.13	2.11
7	2.52	2.43	2.51	2.44	2.50	2.45	2.49	2.46
8	2.88	2.78	2.87	2.79	2.85	2.80	2.84	2.82
9	3.24	3.12	3.22	3.14	3.21	3.15	3.19	3.17
10	3.60	3.47	3.58	3.49	3.57	3.50	3.55	3.52
11	3.96	3.82	3.94	3.84	3.92	3.85	3.91	3.87
12	4.32	4.17	4.30	4.19	4.28	4.21	4.26	4.22
13	4.68	4.51	4.66	4.54	4.64	4.56	4.61	4.58
14	5.04	4.86	5.01	4.88	4.99	4.91	4.97	4.93
15	5.40	5.21	5.37	5.23	5.35	5.26	5.33	5.28
16	5.75	5.56	5.73	5.58	5.71	5.61	5.68	5.63
17	6.11	5.90	6.09	5.93	6.06	5.96	6.04	5.98
18	6.47	6.25	6.45	6.28	6.42	6.31	6.39	6.34
19	6.83	6.60	6.80	6.63	6.78	6.66	6.75	6.69
20	7.19	6.95	7.16	6.98	7.13	7.01	7.10	7.04
21	7.55	7.29	7.52	7.33	7.49	7.36	7.46	7.39
22	7.91	7.64	7.88	7.67	7.85	7.71	7.81	7.74
23	8.27	7.99	8.24	8.02	8.20	8.06	8.17	8.10
24	8.63	8.34	8.60	8.37	8.56	8.41	8.52	8.45
25	8.99	8.68	8.95	8.72	8.92	8.76	8.88	8.80
26	9.35	9.03	9.31	9.07	9.27	9.11	9.23	9.15
27	9.71	9.38	9.67	9.42	9.63	9.46	9.59	9.50
28	10.07	9.72	10.03	9.77	9.99	9.81	9.94	9.86
29	10.43	10.07	10.39	10.12	10.34	10.16	10.30	10.21
30	10.79	10.42	10.74	10.47	10.70	10.51	10.65	10.56
31	11.15	10.77	11.10	10.82	11.05	10.86	11.01	10.91
32	11.51	11.11	11.46	11.16	11.41	11.21	11.36	11.26
33	11.87	11.46	11.82	11.51	11.77	11.56	11.72	11.62
34	12.23	11.81	12.18	11.86	12.13	11.91	12.07	11.97
35	12.59	12.16	12.53	12.21	12.48	12.27	12.43	12.32
36	12.95	12.50	12.89	12.56	12.84	12.62	12.78	12.67
37	13.31	12.85	13.25	12.91	13.19	12.97	13.14	13.02
38	13.67	13.20	13.61	13.26	13.55	13.32	13.49	13.38
39	14.03	13.54	13.96	13.61	13.91	13.67	13.85	13.73
40	14.39	13.89	14.33	13.96	14.26	14.02	14.20	14.08
41	14.75	14.24	14.68	14.30	14.62	14.37	14.56	14.43
42	15.11	14.59	15.04	14.65	14.98	14.72	14.91	14.78
43	15.47	14.93	15.40	15.00	15.33	15.07	15.27	15.14
44	15.83	15.28	15.76	15.35	15.69	15.42	15.62	15.49
45	16.19	15.63	16.12	15.70	16.05	15.77	15.98	15.84
46	16.54	15.98	16.47	16.05	16.40	16.12	16.33	16.19
47	16.90	16.33	16.83	16.40	16.76	16.47	16.69	16.54
48	17.26	16.67	17.19	16.75	17.12	16.82	17.04	16.90
49	17.62	17.02	17.55	17.10	17.47	17.17	17.40	17.25
50	17.98	17.37	17.91	17.44	17.83	17.52	17.75	17.60

N. B. If these TABLES be made use of as right-angled Triangles, for any Purpose besides Surveying, it must be remembered, that the Hypothenuse found in the first Column, is double its proper Length. And whoever uses the Four-pole Chain either *English* or *Irish*, in taking a Survey, must reduce the Lengths of his Stations to Half, or Two-pole Chains, before he enters the Tables; because the Hypothenuses, or lengths of the Stations, in the first Column, are only in two pole Chains, (and therefore their number is doubled); whereas the Differences of Latitudes & Departures are in Four Pole Chains, (~~or~~ 100 Links) or Links. See Page 68.

Here followeth a **CALCULATION** of the **SURVEY** given
of **PRACTITIONERS**, as a **PLAN** for somewhat of the

St.	Bearing.	Leng.	N.	S.	E.	W.	N.	S.	L.N.	L.
1	SE. $89\frac{1}{2}$	20.00	- - -	0.09	10.00	- - -	- - -	0.10	0.10	
2	SE. $71\frac{1}{2}$	41.00	- - -	6.51	19.45	- - -	- - -	6.55	6.65	
3	SE. $72\frac{3}{4}$	36.40	- - -	5.45	17.57	- - -	- - -	5.50	12.15	19.0
4	SW. $17\frac{1}{4}$	41.40	- - -	19.90	- - -	6.37	- - -	19.90		0.0
5	NW. $77\frac{1}{4}$	66.00	7.00	- - -	- - -	32.25	6.94	- - -		6.0
6	NW. $30\frac{3}{4}$	36.25	15.68	- - -	- - -	9.33	15.68	- - -	9.43	22.0
7	NW. $5\frac{1}{4}$	18.48	9.43	- - -	0.95	- - -	9.43	- - -	0.00	
Closes with the First			32.11	31.95	47.97	47.95	32.05	32.05		

Parallel Breadth 47.96
Meridional Breadth 32.05

15371.1180 equal circumscribing Parallelogram
549 0197 equal Angle-Spaces

Acres 98,8.0983 equal Body-of-the-Land
1.74675 equal Off-fets

100.55658 equal whole Content

A. R.
100 2

In my opinion, a return of this sort, drawn on parchment, may do very well for fir
in parcels, there may be a small book of calculations, handsomely drawn out, c

en in page 40, which is likewise offered to the consideration,
he like nature, to be given in return with their Surveys.

L.S.	L.A.	D.S.	E.	W.	Off-fets and In-fets on each Station.
	0.10	001.0000	10.00	- - -	in 0.15-0.15-0.00-0.20 } begins at a Ford. at 0.00-7.50-8.50-10.00
	6.75	131.2875	19.45	- - -	in 0.20-0.15-0.15-0.05 } mears Sq. H—y's Estate. at 0.00-2.00-13.00-20.50
19.90	18.80	330.3160	17.57	- - -	in 0.10-0.00 off. 0.30-1.20-1.00-0.15-0.00 } at 0.00-3.50— 7.70-7.70-10.50-18.50-18.40 }
0.00	19.90	126.9620	- - -	6.38	a Wall the Bounds.
6.94	6.94	223.8150	- - -	32.25	off. 0.10-0.00-0.00-0.20-0.00 in 40 } thro' a Bog. at 0.00-17.60-30.00-31.00-31.50-33.00
22.62	29.56	275.7948	- - -	9.33	in 0.00-3.90-0.00 off. 0.40-2.00-0.30-0.50 } a River. at 0.00-3.50-4.20— 4.20-5.20-11.50-18.25 }
	9.43	008.8642	0.94	- - -	off. 0.90-0.10-0.80 } the River still mears Ur—g—d. at 0.00-3.60-9.48 }

2) 1098 0395 | 47.96 | 47.96

54.9.0197

A CALCULATION of G—N— Esq's;
Holding from E—B— Esq, being
Part of the Lands of B—m—r,
in the Barony of C—h, and County
of Kilkenny; which contains ONE
HUNDRED ACRES, TWO ROODS,
EIGHT PERCHES.

Surveyed in October 1764.

By B. N.

R. P.

2 8

for single farms, without any map: but where there is a large estate to be surveyed
out, of every farm or town-land therein, with references to one general map.

in page 40, which is likewise referred to the consideration
of the nature, to be given in return with their surveys.



ADVERTISEMENT.

THE AUTHOR continues to Survey Land, as usual, for any Gentleman, &c. who is pleased to employ him.——And, all the INSTRUMENTS described in this BOOK, as the THEODOLITE, PROTRACTOR, SCALE, GLASS, and other mathematical Instruments, are very accurately made by *E. SPICER*, in *Dublin*.

ERRATA.

- Page 21, last line but 3. for figure 4 read fig. 3.
- 32, line 12. after A B C add fig. 7.
 - 36, line 4. after A B add fig. 7.
 - 38, last line but 5. for fig. 7 read fig. 5.
 - 52, line 14. after N.S.E.W. add fig. 8.
 - 74, for opposite 35, read opposite 34.
 - 17, l. 12. for CL, read Cl.
 - 17, l. 13. for DL, read Dl.
 - 19, l. 18. for [by Eucl. I.] read by 35 Eucl. I.
 - 19, last line but 3, for ARD read ARB.
 - 20, last line, for RB read AB.
 - 23, last line but 5, for eight-tenths read eight hundredths.
 - 61, for Axiom III. read Axiom II.
 - 75, last line but one, for 6.65 read 6.55.
 - 80, last line but 8, for *no* error read *an* error.
 - 81, l. 7. for rE read *re*.
 - 81, l. 10. for *br* read *Br*.
 - 82, l. 3. for *Bn* read *bn*.
 - 82, l. 11. for Bn—Br read bn—Br.
 - 86, l. 12. for 9th & 10th defin. read 9th & 11th.
 - 100, for Axiom III. read Axiom II.

The Tables were very carefully corrected at the Press, by the AUTHOR.